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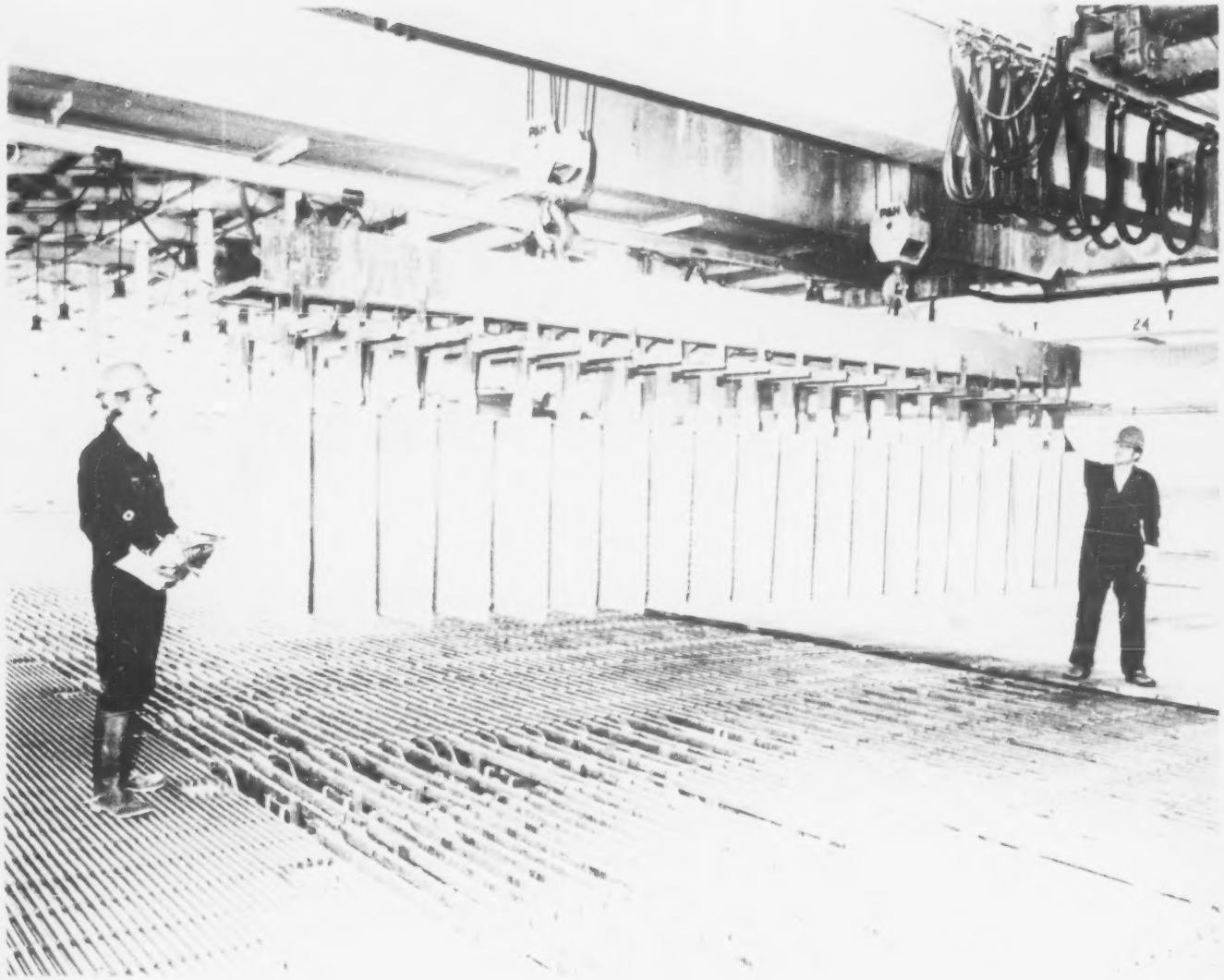
THE PRIMARY COPPER INDUSTRY OF ARIZONA IN 1988



DEPARTMENT OF MINES AND MINERAL RESOURCES

BY RICHARD R. BEARD

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Cover: SX-EW facility at Morenci.
Photo courtesy of Phelps Dodge.

STATE OF ARIZONA
DEPARTMENT OF MINES AND MINERAL RESOURCES

Leroy E. Kissinger, Director

THE PRIMARY COPPER INDUSTRY OF ARIZONA 1988

Special Report No. 15

by
Richard R. Beard, Mining Engineer

December, 1989

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* Throughout this report a "ton" means a short ton (2,000 pounds or 0.90718 metric ton).

Specific statistics may vary slightly from table to table due to differences in source data.

INTRODUCTION

The Arizona Department of Mines and Mineral Resources presents herein a report covering activity in Arizona's copper industry in the calendar year 1988. A brief review of operational highlights reported by the major developers and producers in the State, market and price developments that affected copper production, and discussions of Arizona severance taxes on metalliferous minerals are included.

The contained statistical tables include various production, employment, inventory, import/export, prices, costs, and ore reserve numbers for 1988. Production of recoverable copper is given for individual mines and by company. Figures showing the importance of copper in the mining industry are provided, as are data on the by-products of copper mining; gold, silver, and molybdenum. In addition, historical compilations are included for leach copper, average grade of ore produced, percent copper recovered, open pit mine stripping ratios, and employment and earnings. Additional compilations indicating refined copper inventories in and out of the United States and average copper prices by month from 1979 through 1988 are provided. Also included are tables showing designed mine capacity and copper reserves in Arizona plus average copper cash production costs for the United States, 1982-1986.

The Department maintains extensive reference libraries in its Phoenix and Tucson offices concerning the copper industry in Arizona. These repositories include information on individual mines and mining companies, United States Bureau of Mines and United States Geological Survey publications, other professional publications, periodicals, and earlier editions of this report. Additionally, experienced mining engineers are available for consultation, at no charge, on matters germane to the minerals industry. Office hours are 8 a.m. to 5 p.m. on all non-holiday weekdays.

Figure 1. PRODUCING COPPER PROPERTIES
1988

COPPER PRODUCTION IN ARIZONA - 1988

Arizona's copper industry produced 942,112 tons of copper in 1988 (Table I). This is an increase of 1.1% above 1987 but is still 12.1% below the record production of 1981 (Table IX). Although production was up, Arizona's share of the United States total was down to 59.5% from 61.4% (Table XXIV) primarily due to the resumption of production at Bingham Canyon in Utah.

The gross value of non-fuel mineral production in Arizona in 1988 was up 60% above 1987 to $2,829,187,000 (Table X) mostly due to improved copper prices. Copper production represents 79.3% of this total; the by-products of copper production (gold, silver and molybdenum) represent an additional 4.9% (Table IX). The total contribution of the copper mines was therefore 84.2% of the gross value.

Copper was produced by 6 companies from 14 properties in 1988 and molybdenum was recovered as a co-product or by-product at 6 of these properties (Tables III & IV). Eight properties produced 98.3% of Arizona's copper and 3 produced 92.7% of the molybdenum. The Morenci-Metcalf mine of Phelps Dodge led in copper production with 31.5% of the total. The Sierrita- Esperanza complex produced 59.6% of the molybdenum.

More than 217,000 tons of copper representing 23.1% of the total was produced by leaching in 1988. Solvent extraction-electrowinning produced almost 199,000 tons of cathode copper from these leach solutions. The remaining 19,000 tons were precipitated as cement copper (Table I).

Stripping of waste, including some leachable material, was accomplished at the 9 operating open pit mines during 1988. The weighted average of the stripping ratios - waste to ore - was 1.49 to 1 (Table VIII). This is an increase from 1.21 to 1 in 1987 which probably indicates normal long range mine planning.

The weighted average grade - percent copper - of sulfide ores mined in 1988 was 0.60% copper (Table VI). This is lower than the average of the last 10 years and reflects the confidence of the copper industry.

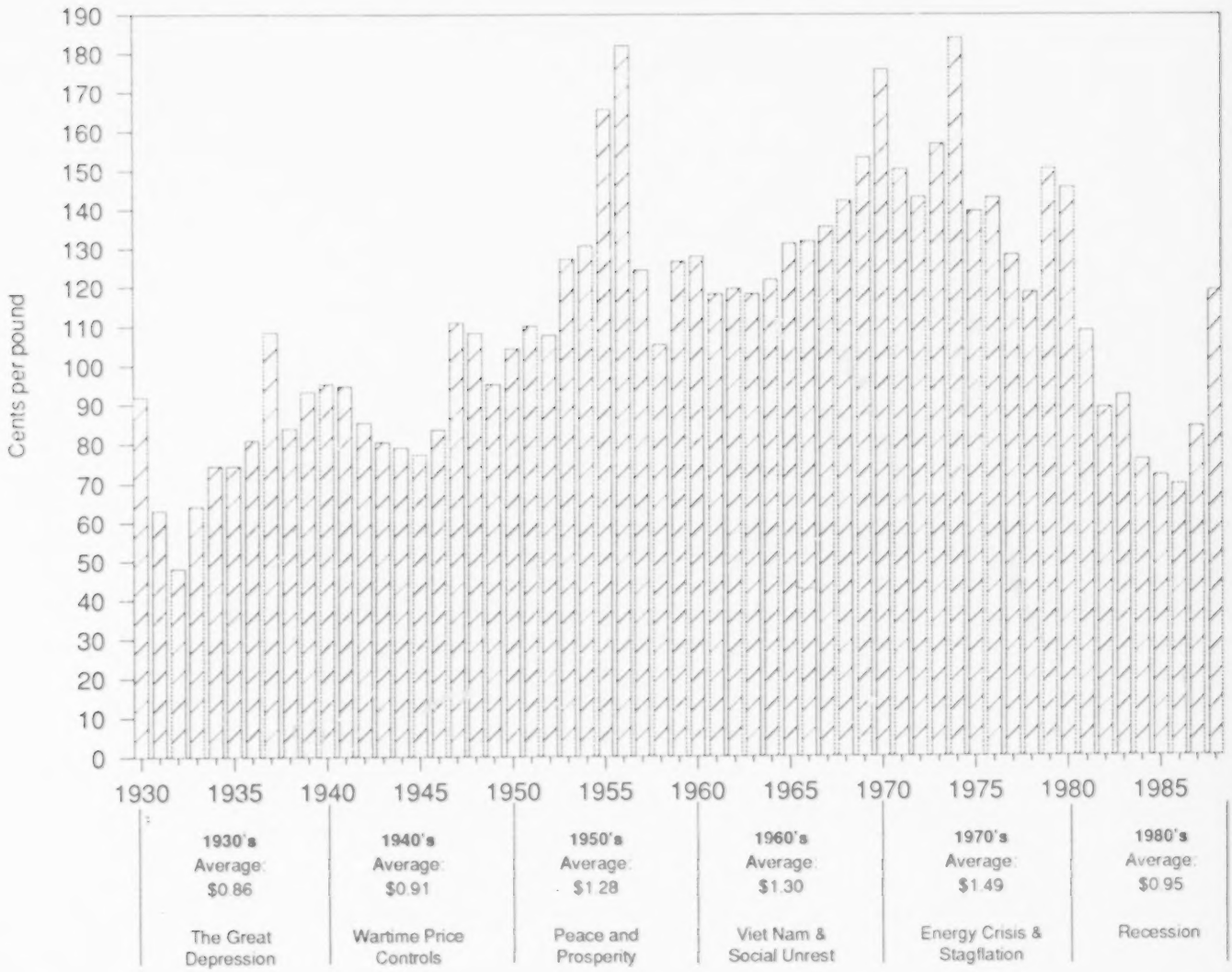
The estimated capacity to produce copper at each of Arizona's principal operations totals 1.131 million tons annually (Table XI). By this estimate the mines, concentrators and leach facilities operated at 83.3% of capacity in 1988.

The copper reserve base in Arizona by company and property is estimated in Table XIII. The reserve base as defined in "Mineral Facts and Problems" 1985 Edition, Bureau of Mines Bulletin 675, page 3, includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently sub-economic (sub-economic reserves). The many technical, political, social, and economic variables render a listing of actual economic reserves inappropriate.

1988 OPERATIONS SUMMARY

Operating properties	14
Operating companies	6
Operating smelters	3
Ore mined (includes some oxides)	175,261,000 tons
Ore milled (sulfides)	152,731,000 tons
Waste/overburden removed (includes some leach material)	242,697,000 tons
Average stripping ratio	1.49:1
Copper produced	942,112 tons - 59.5% of U.S.
From sulfide ores	725,088 tons - 76.9% of AZ
Average grade	0.60% copper
From leaching	217,469 tons - 23.1% of AZ
SX-EW	198,756 tons - 91.4% of leached, 21.1% of total
Precipitation	18,713 tons - 8.6% of leached
Molybdenum produced	29,132,000 pounds
Silver produced	3,181,000 troy ounces
Gold produced	93,000 troy ounces
Average employment	10,588
Average annual wage	$33,008
Productivity	125 lb of copper per man-hour, 11.6 tons of ore per man-hour

Figure 2. COPPER PRICE IN CONSTANT 1988 DOLLARS



Source:
U.S. Gross National Product Deflator Price Index - U.S. Bureau of Economic Analysis
U.S. Producer Price Index of Intermediate Materials for Durable Manufacturing - U.S. Bureau of Labor Statistics
U.S. Consumer Price Index (CPI) - U.S. Bureau of Labor Statistics
Historic Prices - Metals Week: Copper, Wire Bars

As reported in *Non-Ferrous Metal Data, 1983* and *1988*, American Bureau of Metal Statistics

STATUS AND PROGRESS

Arizona's copper industry can look back at 1988 with satisfaction. The policies and programs set in motion in 1985 in the effort to survive 65 cent copper prices provided substantial profits at the average price of $1.20 for the year. Profits are being made in spite of the fact that in constant 1988 dollars $1.20 is well below the average price of $1.35, which was recorded for the three decades prior to the 80's (1950-1980) and is not much above the $1.13 average of the last six decades. This period includes the great depression, the price controlled war years, Nixon's price controls in the 70's and the disastrous 80's.

The temptation to develop new ore bodies was resisted because the industry believed that investment in the increase of production capability and efficiency at producing properties was a wiser use of available capital. The reactivation of Twin Buttes, which could almost be considered an expansion of Sierrita, and the start of in-situ leaching and cementation at the Van Dyke are the exceptions.

The Kadish Decision which struck down the flat 5% royalty on mineral production from State owned land was in effect, upheld by the U.S. Supreme Court. The Arizona Legislature passed a bill to modify the leasing system to satisfy the conditions of the decision.

Unfortunately this bill will essentially eliminate exploration and development of mineral resources on State owned land. Those operations now producing will be able to accommodate the new rules while times are good, but will probably be forced into early shut down in the low end of the traditional boom and bust cycle experienced by the mining industry.

OPEN PIT MINING

The majority of the copper is produced by open pit mining methods. So far most of the improved efficiency has been the result of consolidation, preplanned maintenance, scheduling and utilization of equipment. The computer dispatching at Morenci is but one example of this. Now, however, major changes in operating methods are being instituted.

At Morenci, Phelps Dodge has gone from an all rail haulage system, through an interim system using trucks to service the shovels and haul to in-pit transfer points for rail haulage to the concentrators, to the In Pit Crushing and Conveying system (IPCC).

Cyprus has acquired the Twin Buttes property to provide additional feed to the Sierrita mill as well as oxide ore for the Twin Buttes Oxide plant.

Magma's Pinto Valley division has started slurrying the old No. 2 tailings at Miami, leaching them and redepositing them in the mined out Cities Service Pit.

UNDERGROUND MINING

San Manuel is the only operating underground copper mine in Arizona. Development of Asarco's underground ore body at Sacaton and Phelps Dodge's Safford property has been suspended indefinitely. With the exception of the possible reopening of the Magma Mine at Superior, no underground development is under consideration in Arizona.

IN-SITU MINING

In-situ leaching of rubbleized copper bearing material remaining in mined out

underground stopes has long been practiced in Arizona. At San Manuel, Magma is developing a more formalized program of leaching mined out block caving stopes and is approaching production status. During the last few years all of the production from the Lakeshore property has been from a similar system developed by Noranda. Cyprus is continuing this project as well as the tests initiated by Noranda into in-situ leaching of non-rubbleized or virgin ground. Kocide Chemical is now producing copper from the Van Dyke property at Miami in this fashion, taking advantage of the test work conducted by Occidental Minerals Corporation.

The U.S. Bureau of Mines is funding tests of in-situ leaching of virgin ground in Arizona. Science Applications International Corporation has been awarded a contract to identify analytical procedures and develop computer algorithms that could be used to select the best in-situ mining method for any specific copper oxide deposit. Asarco is cooperating with the Bureau at the Santa Cruz property near Casa Grande. The Santa Cruz ore body is a deep seated acid soluble deposit which is owned by Asarco and Freeport McMoran on a 50-50 basis.

SOLVENT EXTRACTION

Traditionally the copper produced from leach solutions has been extracted by cementation process (precipitation from solution by the replacement of copper in solution by metallic iron). This has been a source of relatively cheap copper, but the cement copper produced must be smelted and refined along with the flotation concentrates.

During the 1960's, Ranchers Exploration and Development Corporation pioneered the use of solvent extraction-electrowinning to produce copper from its Bluebird property near Miami. The obvious advantage of this method is that cathode copper of salable quality can be produced directly from leach solutions. Smelting, with its pollution problems, and further refining are therefore not required.

During the relatively good years experienced by the industry after Rancher's introduction of solvent extraction-electrowinning, interest in the process grew gradually. The disastrous 80's prompted an accelerated interest in it, however. Nine plants operated during 1988. Several expansions or new plants are planned and the cementation process is being phased out except as a subsidiary method.

CONCENTRATION

The overwhelming majority of copper mineralization in Arizona is of the sulfide type and is not amenable to leaching without extraordinary means. Inspiration has had success with its heap leach-ferric cure process on mixed oxide-sulfide ores and Kennecott pioneered the use of bacteria to convert sulfides to oxides in low grade dumps. However, as shown in Table I, about 80% of the copper was produced by the flotation method of concentration. In addition much of the leached copper produced is from dumps of "waste" that was stripped from open pit mines to provide access to sulfide ore. Another aspect of the flotation process that makes it viable at some properties is the recovery of molybdenum by selective flotation. Molybdenum provides a significant portion of the revenues from some properties. Also, any precious metals in the ore follow the copper through the flotation process and smelting to the electrolytic refinery where they can be recovered from the anode slimes.

There are currently eight flotation concentrators in operation in Arizona. Asarco

is operating 2 - Ray and Mission, Cyprus is operating 2 - Bagdad and Sierrita, Magma is operating 2 - San Manuel and Pinto Valley, and Phelps Dodge is operating 2 at Morenci-Metcalf. Six are on standby; Magma's at Superior, Asarco's at Silver Bell, Cyprus' at Mineral Park, Esperanza, and Miami, and Phelps Dodge's at Ajo.

Although efficiency is constantly being improved, the flotation process is not cheap. It requires crushing and grinding the ore, separation of the ore minerals from the gangue minerals in the flotation cells, smelting the concentrate, and refining the copper anodes from the smelter. The most significant development in flotation is the column flotation cell being installed in most concentrators.

SMELTING

Of the five smelters remaining in Arizona in 1988 only three operated. Asarco's Hayden smelter and Cyprus' smelter at Miami have been brought into compliance with air pollution constraints and Magma's smelter at San Manuel has been retrofitted with an Outo-Kumpu flash furnace to bring it into compliance. The Ray smelter at Hayden that Asarco acquired from Kennecott met all significant environmental constraints when last operated in 1982 and is available if needed. Phelps Dodge's smelters at Ajo and Morenci will require extensive retrofitting before they can be operated. Phelps Dodge is shipping concentrates to its Hidalgo smelter at Playas, New Mexico and to the Chino smelter at Hurley, New Mexico that was recently acquired from Kennecott. Excess concentrates are being sold.

As an alternative to smelting, Cyprus Casa Grande has reactivated the Roast-Leach-Electrowinning (RLE) plant built by Hecla at the Lakeshore property. In this process flotation concentrates are roasted to make them acid soluble and leached with sulfuric acid. Salable cathode copper is extracted from the leach solution by electrowinning. Cyprus is upgrading the leach solutions in the solvent extraction plant before electrowinning. Acid is produced from the roaster gases and the process is essentially pollution free.

A portion of the concentrates from Sierrita are being processed at this plant.

PROGNOSTICATION

The expected softening of copper prices in 1988 did not occur and thus far 1989 appears destined to be a banner year for Arizona's copper producers. Political and labor difficulties being experienced by the foreign producers will prevent overproduction such as occurred in the mid eighties. However, should all these difficulties be resolved, the government run producers probably will not resist the urge to continue production in the face of a glut of copper on the market. They will again be more interested in maintaining political and labor stability than in maintaining market stability. This potential for over production will continue to suppress the possibility of any new major ore bodies being developed in Arizona. The time required to put a new property into production could be sufficient to allow the foreign producers and governments to resolve their problems and flood the market. It is also expected that production will continue to be increased at currently operated properties. Some idle past producers could be reactivated and some smaller, less capital intensive properties may be brought on line. Arimetco's acquisition of the Johnson Camp and Emerald Isle properties, Arizona Copper Companies' plans for the Sanchez property and South Atlantic Venture's acquisition of the Oracle Ridge Mine are some examples.

If the industry can survive the good times without once again being invaded by companies that do not understand the mining business, without being overtaxed and without being regulated to excess, it will be in good shape to weather the inevitable nadir of the copper price cycle.

ASARCO INCORPORATED

Corporate Headquarters - 180 Maiden Lane, New York, New York 10038 - Phone (212) 669-1000

In Arizona, Asarco operates copper mines at Sahuarita, Ray and Silver Bell and a copper smelter at Hayden. In Texas, they operate a copper smelter at El Paso and a copper refinery at Amarillo. They also hold major interests in MIM Holdings Limited, Mexico Desarrollo Industrial Minero, S.A. (MEDIM-SA) and Southern Peru Copper Corp. (SPCC).

In addition to copper, Asarco mines and refines lead, zinc, gold and silver and produces coal, industrial minerals and chemical and manufactured products.

During 1988 Asarco continued its restructuring and modernization program including the 46% expansion at Mission that was completed in February, 1989. A three year, $260 million project to increase production by 40% is planned for Mission, Ray and El Paso. Scheduled for completion in 1992, this expansion will make Asarco independent of outside sources of feed for its smelters.

As a part of this project, $30 million will be spent to retrofit the reverberatory furnaces at El Paso with Con Top smelting units manufactured by KHD of West Germany.

Tucson Office - 1150 N. 7th Ave., P.O. Box 5747, Tucson, Arizona 85703 - Phone (602) 792-3010

The Tucson office houses the Southwest Mining Department, the Mining Department/Corporate Office, the Mineral Beneficiation Department, the Exploration Department, the Acid Sales Department and the Department of Safety and Technical Employment.

During 1988 Asarco's Arizona operation consisted of a major copper smelter at the Hayden Unit, major open pit mines at the Mission and Ray Units, and a dump leaching/cementation operation at the Silver Bell Unit. With the increased production at the Mission Complex, Asarco is able to produce 67% of the feed to its smelters.

Asarco and Freeport McMoran formed the Santa Cruz Joint Venture managed by Asarco. It is participating with the U.S. Bureau of Mines in an in-situ leaching experiment at the Santa Cruz deposit seven miles west of Casa Grande. This large deep seated deposit will be used to determine the feasibility of in-situ leaching of undisturbed virgin ground and to develop a data base for application to other suitable deposits. Hydrologic studies will be followed by the design and development of the leach field and the design of the pilot solvent extraction-electrowinning (SX-EW) plant. In December, 1988 the Joint Venture bought the adjacent Casa Grande deposit that added 300 million tons of reserves. Asarco also holds major reserves at the Chilito north of Hayden, at Helvetia, east of the Mission Complex and at Sacaton East.

Hayden Unit

Box 98, Hayden, Arizona 85235 - Phone (602) 356-7804

The Hayden Unit consists of an INCO flash furnace smelter rated at 940,000 tons of charge per year for an estimated production of 175,000 tons of blister copper. An acid plant rated at 2,800 tons of sulfuric acid

per day keeps sulfur dioxide emissions within air quality restraints.

In 1988 Asarco began construction of a holding furnace at Hayden to improve the operating rate. Although with the acquisition of Ray and the increased production at Mission, Asarco will provide about two-thirds of its smelter feed, the company will still fill its traditional role as a custom and toll smelting company.

Mission Unit

Box 111, Sahuarita, Arizona 85629 - Phone (602) 791-2920

The Mission Unit consists of the consolidation of the Mission, Eisenhower, San Xavier, and Pima open pit mines into one large open pit referred to as the Mission Complex. Also included is the smaller San Xavier North pit. The acquisition of the rest of the Eisenhower in April and of the Mineral Hill deposit adjacent to the Pima section of the open pit late in 1987 increased reserves and facilitates further efficiencies in pit design and mine planning.

Mining is conducted by electric shovels with truck haulage to the primary crusher and waste dumps. Some areas of the pit are back to final limits allowing some waste dumping in pit. The stripping ratio in 1987 was 2.02:1, waste to ore.

The concentrator capacity was increased from 29,000 tons per day to 41,000 tons per day during 1988. This was accomplished by lengthening the 10.5 foot diameter ball mills from 15 feet to 18 feet, installing 2 new ball mills salvaged from the Sacaton mill, converting some of the cleaner flotation cells to roughers and installing six 8x52 foot column flotation cells for cleaners.

Asarco exercised its option to purchase the Pima Mill at the Mission Complex which will add 19,000 tons per day milling capacity. Of the $260 million capital spending program, $100 million is earmarked to refurbish this mill and expand mining capacity to feed it by mid-1990.

Ray Unit

P.O. Box 9, Hayden, Arizona 85235 - Phone (602) 356-7811

The Ray Unit consists of an open pit mine, dump leach and heap leach operations, and a 40,000 ton per year SX-EW plant at Ray and a 26,000 ton per day concentrator at Hayden. The 400,000 ton per year smelter and 900 ton per day acid plant at Hayden are on stand-by status.

Mining is conducted by electric shovels supplemented by front-end loaders utilizing truck haulage. The production rate is 100,000 tons per day of which 26,000 tons are sulfide ore sent to the mill, and 10,000 tons are silicate ore that is crushed and sent to the leach heaps. The remainder is low grade sent to leach dumps or waste sent to waste dumps. The stripping ratio in 1988 was 2.10:1, waste to ore. The mine plans are predicated on the sulfide operation and therefore silicate ore is stockpiled when in excess and fed from the stockpile to the crushers when short.

Sulfide ore is hauled by truck to the primary crusher at Ray where it is crushed and transferred to trains for the 20 mile haul to the mill.

Silicate ore is hauled to the primary crusher then further reduced to minus 3/4 inch by secondary and tertiary crushers. It is then transported by conveyor where it is agglomerated with sulfuric acid while in transit to the heap leach area. Final haulage and placement on the heaps is by end-dump trucks.

Low grade muck is hauled to prepared leaching areas and non-mineral muck is hauled to waste dumps by end dump trucks. All leach solution are now fed to the SX-EW plant.

Previously stockpiled native copper ore is being reclaimed and fed to the mill in small proportions as is smelter slag.

A $12 million project was started in 1988 to maintain production capacity as the hardness of the ore increases as the pit deepens. In addition, $130 million of the $260 million expansion project will be spent at the Ray Unit. A 60,000 ton per day portable in-pit crusher and conveying system will replace the 30,000 ton per day primary crusher at the pit and a 20,000 ton per day concentrator will be built at the mine site. Concentrates will be hauled by rail to the smelter at Hayden and the tailings will be piped to the present tailing ponds at Hayden. The project is scheduled for completion in 1992.

Silver Bell Unit

Marana, Arizona 85653 - Phone (602) 622-6551

The Silver Bell Unit consists of an open pit copper mine and an 11,000 ton per day concentrator that are both on stand by status. The dump leaching operation and precipitation plant are in operation. Reactivation of the mine and mill is under consideration.

CYPRUS MINERALS COMPANY

Corporate Headquarters - 9100 E. Mineral Circle, P.O. Box 3299, Englewood, Colorado 80112 - Phone (303) 643-5000

Cyprus has continued to grow. In March 1988 it entered into a 15 year lease of the Twin Buttes property formerly operated by Anamax and in July 1988 they acquired the entire Inspiration property at Miami including the mines, concentrator (inactive), SX-EW plant, smelter, acid plant, electrolytic refinery, and rod plant. Cyprus was the second largest producer of copper in 1988 and continued to be the largest producer of molybdenum.

In addition to its copper-molybdenum properties, Cyprus operates Arizona's largest gold mine, the Copperstone north of Quartzsite, and has entered into a joint venture agreement with Magma to explore the old Mammoth mine, which is a part of Magma's San Manuel property, as a possible gold operation. Cyprus would be the operating partner.

Cyprus has grown on a worldwide basis as well as in Arizona. It operates the Thompson Creek molybdenum mine in Idaho and in July, 1988 it acquired the molybdenum mine at Tonopah, Nevada.

In Australia Cyprus owns a share of and operates the Gidgee, Selwyn and Moline gold mines and has a share of the Sheahan-Grants gold mine. In New Zealand it is developing the Golden Cross Project.

In 1988 Cyprus produced coal from 9 mines in Colorado, Kentucky, Pennsylvania, Utah, West Virginia and Wyoming; talc in Montana, Vermont, Alabama, and Spain; and barite in Georgia. With the acquisition of Foote Mineral Company in April of 1988 it became the major producer of lithium from salt brines in the Silver Creek facility in Nevada and in northern Chile.

Cyprus' latest acquisition to date is the Reserve Iron Operation in northern Michigan in 1989.

Cyprus Bagdad

P.O. Box 245, Bagdad, Arizona 86321 - Phone (602) 633-2241

The Bagdad operation consists of an open pit copper-molybdenum mine, a 54,000 ton per day concentrator, a dump leach operation and an SX-EW plant. Copper concentrates were shipped to Inspiration (now Cyprus Miami)and Magma, and to Japan during 1988. The SX-EW cathodes and molybdenum oxide are sent directly to market.

Mining is conducted by electric shovels using truck haulage to the primary crusher and dumps. The stripping ratio in 1988 was 1.96 to 1, waste to ore.

The sulfide ore is transported from the primary crusher at the mine, a distance of 6,400 feet to the coarse ore stockpile at the concentrator, by conveyor belts. There it is crushed further, ground by autogenous and ball mills and copper and molybdenum concentrates are produced. Column cells are utilized in the molybdenum flotation circuit.

Dual process ore (sulfide ore with an unusually high oxide content) is placed in heaps and leached for 60 days before being sent to the concentrator.

Pregnant solutions from the leach dumps are collected behind dams and pumped to the SX-EW plant at approximately 1.8 grams of copper per liter. The barren solutions are returned to the dumps after the copper has been extracted.

Cyprus Casa Grande

P.O. Box C-9, Casa Grande, Arizona 85222 - Phone (602) 623-1539

The Casa Grande operation consists of an in-situ leaching operation and an SX-EW plant. The block caved stopes in the oxide orebody are being leached and development of a leaching operation in virgin ground is underway using high pressure pumps to inject sulfuric acid solution into holes drilled from the old underground workings. Pregnant solutions are collected in sumps underground and pumped to the SX-EW plant.

The roasters and acid plant of the Roast-Leach-Electrowinning (RLE) plant built by Hecla have been refurbished and are treating concentrates from Sierrita. The pregnant solutions go to the SX-EW plant and the acid produced from the roaster gases is used for the leaching operations.

Cyprus Miami

P.O. Box 1559, Claypool, Arizona 85532 - Phone (602) 473-7150

The Cyprus Miami properties consist of three open pit copper mines formerly called Inspiration Mines, a 24,000 ton per day concentrator that is currently on standby status, a 380,000 ton per year electric furnace smelter, acid plant, SX-EW plant, electrolytic refinery and a 135,000 ton per year rod plant.

The ore is mined at the rate of 50,000 tons per day with electric shovels and hauled by truck to high grade, low grade and waste dumps. The stripping ratio in 1988 was 2.01:1, waste to ore. Soon after Cyprus acquired the property the construction of the second, nearly identical, solvent extraction train was completed that increased the capacity of the plant to 8,000 gallons per minute. The 25 cycle AC to DC motor-generators were replaced with modern rectifiers to increase the capacity and efficiency of the tank house. The cathodes from both the electrowinning and electrorefining sections are fed to the continuous cast rod plant to produce 5/16 inch copper rod on reels holding three and one-third miles of rod each.

Cyprus Mineral Park

P.O. Box 6249, Kingman, Arizona 86401 - Phone (602) 565-2226

The Mineral Park property consists of an open pit copper-molybdenum mine and a 15,000 ton per day concentrator that are both on stand by status. The dump leaching operation and the precipitation plant are in operation and some in-pit leaching is also being conducted.

Cyprus Sierrita

P.O. Box 527, Green Valley, Arizona 85622 - Phone (602) 791-2950 & (602) 625-4800

The Cyprus Sierrita property consists of an open pit copper-molybdenum mine, a 100,000 ton per day concentrator, a ferromolybdenum plant, a rhenium plant, a dump leaching operation, and an SX-EW plant. The Esperanza pit and 17,500 ton per day concentrator were inactive during 1988 with the exception of the crushers that were used to supplement the Sierrita mill crushers.

Mining is conducted using electric shovels and truck haulage to the crushers and dumps. The stripping ratio in 1988 was 0.67:1, waste to ore. Dump leaching and precipitation began in the early 1960's.

When production ceased at Johnson Camp the SX-EW plant was moved to Sierrita to replace the precipitation plant. Lead anodes, titanium cathodes, extractants and other equipment and reagents were brought from Battle Mountain and Anamax to complete the installation and startup.

Twin Buttes Project

Production was started at the Twin Buttes mine in 1988 providing additional feed to the Sierrita Mill.

INSPIRATION RESOURCES CORPORATION

Corporate Headquarters - 250 Park Avenue, New York, New York 10197 - Phone (212) 503-3100

Inspiration Consolidated Copper Co.

All properties, plants, equipment, offices and problems were purchased by Cyprus and are described thereunder. Something should be said here, however, so bear with me while I wax nostalgic. Some grand old names have vanished from the Arizona scene. Miami Copper several years ago and more recently Kennecott to name but two. The loss of Inspiration Consolidatd Copper Co., however, seems saddest to me.

I was born in her hospital, delivered by her doctors and raised in her shadow through the great depression and World War II. She provided sustenance, hope and a degree of stability to the Globe-Miami area throughout the greater part or the 20th century and will be mourned by all.

I am consoled, however, by the fact that a young aggressive, imaginative company has taken over where she left off. I feel certain that the property and the community are in good hands and I expect that the name Cyprus Miami will be a hallmark of Gila County well into the next century.

KOCIDE CHEMICAL CORPORATION

Corporate Headquarters - 1508 N. VP Blvd. Casa Grande, AZ 85222 - Phone (602) 836-0607

Kocide, a subsidiary of the Griffin Corporation of Valdosta, Georgia, operates a plant in Casa Grande that manufactures agricultural products. The cement copper from the Van Dyke is used to produce copper sulfate used in the manufacture of these products.

Van Dyke Mine

P.O. Drawer D., Miami, AZ 85502 - Phone (602) 473-2421

Production from the Van Dyke in-situ leaching project started in December, 1988. Initially Kocide is injecting sulfuric acid solution into the old underground stopes and recovering pregnant solution form production wells. Cement copper is precipitated in Kennecott cones using shredded, detinned cans as the precipitant. The planned rate of production is 4,000,000 pounds per year.

In-situ leach tests are being conducted in virgin ground to continue production after the old stopes are exhausted.

MAGMA COPPER COMPANY

Corporate Headquarters - P.O. Box M, San Manuel, Arizona 85631 - Phone (602)385-3100

In March 1987, after nearly 20 years as a wholly owned subsidiary of Newmont Mining Corporation, Magma once again became an independent corporation. As such it has continued implementing an extensive expansion and modernization program to meet all environmental constraints and to become competitive in the copper

market. As part of this program the company housing in the town of San Manuel is being sold.

Magma's Arizona operations are divided into the San Manuel Division and the Pinto Valley Division which include the Pinto Valley Unit and the Miami Units. The original Magma Mine at Superior was closed in 1982 and remained inactive throughout 1988. However, dewatering was commenced in 1989 as the first step in an evaluation of the feasibility of resuming operations.

Magma also operates a 29 mile railroad from San Manuel and a 28 mile railroad from Superior. Both connect to the Santa Fe Southern Pacific system.

A wholly owned subsidiary, MCR Products, operates a rod plant rated at 140,000 tons per year, in Chicago, Ill.

San Manuel Division

P.O. Box M, San Manuel, Arizona 85631 - Phone (602) 385-3100

The San Manuel Division consists of a block-caving underground copper- molybdenum mine, a 62,000 ton per day concentrator, an open pit oxide copper mine, pad leach, in-situ leach, SX-EW plant, an 800,000 ton per year smelter with a 2000 ton per day acid plant and a 300,000 ton per year electrolytic refinery and a 180,000 ton per year rod plant.

After development of the grizzly and haulage levels, caving is initiated by undercutting the ore block. The caved ore is drawn through the grizzlies to the haulage level. Haulage to the production shafts is by 23 ton trolley locomotives pulling ten 15-17 ton ASEA cars or fifteen 12-13 ton rotary dump cars. After hoisting to the surface the ore is hauled by rail to the mill in 100 ton cars in groups of 35 to 40 pulled by 125 ton diesel-electric locomotives.

The 62,000 ton per day concentrator was modernized by installing larger but fewer cyclones, by replacing controls with programmable controllers, by replacing small flotation cells with nine 2000 cubic foot Maxwell cells and seventy-two 300 cubic foot machines in the rougher circuit and by replacing conventional cells with column cells in the cleaner circuit.

At the smelter the reverberatory furnaces were replaced with an Outokumpu Flash Smelting Furnace. At a design capacity of 3000 tons of concentrate per day, it is the largest single furnace smelter in the industry. An oxygen plant and modifications to the acid plant were a part of the modernization.

Mining at the open pit oxide mine is accomplished with hydraulic excavators and front end loaders with truck haulage at the rate of 19,000 tons of ore and 33,000 tons of waste per day. Ore is placed on the polyethylene lined leach pads and some of the waste is dumped in the subsidence area. Any sulfide ore that is encountered is hauled to a railroad siding and added to the feed going to the concentrator. Copper is recovered from the leach solutions at the SX-EW plant that uses the ISA process of plating the copper on stainless steel sheets rather than on copper starter sheets. The solutions from the insitu leaching are also fed to this plant that was expanded to a capacity of 50,000 tons of copper per year.

Cathodes from the electrolytic refinery and the SX-EW plant are melted and cast into continuous rods at the rod plant.

Pinto Valley Division

P.O. Box 100, Miami, Arizona 85631 - Phone (602) 425-7611

The Pinto Valley Division consists of the Pinto Valley Unit and the Miami Unit. At the Pinto Valley Unit mining is accomplished with electric shovels and truck haulage to the 60,000 ton per day concentrator. A dump leaching and a 6000 gpm SX-EW plant are also in operation. The concentrates and cathodes are shipped to San Manuel.

At Miami solutions from the in-situ leaching of the old Miami Copper block cave area are treated by SX-EW. Construction of the project to slurry and leach the Miami Copper Company tailings from #2 tailing dam continued in 1988 with a projected start-up in 1989. This is a project to slurry the tailings by hydraulic mining, leaching with sulfuric acid, thickening, extracting the copper at the SX-EW plant, and pumping the tailings to the mined out Cities Service pit at Sleeping Beauty. To accommodate the additional solution the solvent extraction plant at Miami was modified and the electrowinning tank house was expanded to a capacity of 6,000 gallons per minute of pregnant solution. The tailing thickeners at the old mill were rebuilt to separate the pregnant solution from the solids after leaching.

PHELPS DODGE CORPORATION

Corporate Headquarters - 2600 North Central Avenue, Phoenix, Arizona 85004- 3015 - Phone (602) 234-8100

Phelps Dodge Mining Company was formed in September, 1988 as one of two operating divisions of Phelps Dodge Corporation. It is the nation's largest copper producer and in 1988 it accounted for one-third of the nation's copper production at its mines in southeastern Arizona and southwestern New Mexico. In conjunction with its Arizona operations, Phelps Dodge operates the Hidalgo Smelter near Playas, New Mexico, a 420,000 ton per year refinery at El Paso Texas, a mine at Tyrone and the Chino Mine near Silver City, New Mexico in which it acquired a two-thirds interest from Kennecott at the end of 1986. These properties contributed 236,600 tons of copper to Phelps Dodge's account in 1988.

The Chino Mines Branch consists of an open pit copper mine, a 45,000 ton per day concentrator, a dump leach precipitation plant, a 500,000 ton per year INCO Flash smelter with an acid plant, and a 45,000 ton per year solvent extraction-electrowinning plant. The mine and concentrator are located at Santa Rita about 15 miles east of Silver City. The smelter is located about 9 miles south of the mine at Hurley.

At Tyrone, about 10 miles south of Silver City, Phelps Dodge operates an open pit copper mine and concentrator that produced 115,700 tons of copper in concentrates and precipitates in 1988. The solvent extraction-electrowinning plant, which was recently expanded to 55,000 tons per year, produced an additional 45,000 tons of copper in 1988.

The Hidalgo smelter near Playas, New Mexico is an OutoKumpo flash furnace rated at 500,000 tons per year. During 1986 the oxygen enrichment plant from the Morenci smelter was installed to increase capacity and efficiency. The resulting increase in sulfur dioxide concentration of the

gases improved the operation of the acid plant as well.

The development of an underground mine at the Dos Pobres property near Safford, Arizona was suspended in 1982, allowed to flood in August 1984, and remains inactive. In 1986 Phelps Dodge acquired the nearby Lone Star property from Kennecott.

At Copper Basin near Prescott, Phelps Dodge has continued to pursue a land trade with the Forest Service. This property is being considered as a possible replacement for the Tyrone operation that is scheduled to cease mining operations in the early 1990's.

In addition to its Arizona-New Mexico copper properties Phelps Dodge operates a fluorspar mine in South Africa through its wholly owned subsidiary Phelps Dodge Mining (Pty) Limited and two copper-gold mines in Chile through its wholly owned subsidiary Compania Minerao Ojos del Salado SA. It also has interests in Black Mountain Mining Development Company (Pty) Limited, which operates a major lead-silver-zinc-copper mine in South Africa, and Southern Peru Copper Corporation in Peru.

Phelps Dodge Industries, the other operating division of Phelps Dodge Corporation, produces carbon black through its wholly owned subsidiary Colombian Chemical Company, wheels and rims for heavy trucks through Accuride Corporation acquired in March, 1988, and Magnet Wire, etc. through Phelps Dodge Magnet Wire Company.

Morenci Branch

Morenci, Arizona 85540 - Phone (602) 865-4521

The Morenci Branch consists of the combined Morenci-Metcalf open pit copper mine, the 60,000 ton per day Morenci concentrator with a molybdenum circuit, the 40,000 ton per day Metcalf concentrator, and a dump leach - SX-EW operation. The 650,000 ton per year smelter with a 2400 ton per day acid plant remain inactive and will require extensive modifications to meet air quality restraints if ever reactivated. Sumitomo Mining Arizona, Inc. holds an undivided 15% interest in the Morenci branch excluding the inactive smelter.

Mining is conducted with electric shovels and truck haulage utilizing a computer controlled Modular Mining Truck Dispatching System for maximum efficiency. During 1988 the trucks delivered ore to the truck-train transfer stations where it was loaded onto rail cars for haulage to the concentrators. Completion of the in pit crushing and conveying (IPCC) system will eliminate rail haulage completely. The trucks will be dumped into the two semi-mobile primary crushers in the pit and the crushed ore will be conveyed to the coarse ore stockpile by conveyor belt. Each concentrator will be fed by conveyors running under the stockpile. Both concentrators are standard flotation mills except that column flotation cells have been installed in the cleaner circuit of each. Total production of these two concentrators was 242,900 tons of copper in 1988.

All mined material other than ore is classified as leach material and is taken to one of several leach dumps. There are three

widely spaced solvent extraction plants to upgrade the solutions before they are pumped to the centrally located tank house for electrowinning. The total capacity of the SX-EW system is 30,000 gallons per minute of pregnant leach solution. The production in 1988 from the SX-EW system was 50,200 tons of cathode copper. In addition nearly 4,000 tons of copper were cemented. The SX-EW system is currently being doubled in capacity.

Copper Queen Branch

Highway 92, Bisbee, Arizona 85603 - Phone (602) 432-3621

The Copper Queen facility consists of a dump leaching and precipitation operation at the mined out Lavender pit.

A drilling program on an area north of the Lavender pit was conducted in 1987 to define a possible ore body amenable to treatment by heap leaching and SX-EW. The results of a feasibility study are not yet available.

New Cornelia Branch

Ajo, Arizona 85321 - Phone (602) 387-7451

The New Cornelia Branch consists of an open pit copper mine, a 30,000 ton per day concentrator with a molybdenum circuit and a 190,000 ton per year smelter with an acid plant. The mine has been inactive since August 1984 and the smelter was shut down in April 1985. There are no immediate plans to reactivate the operation but it is being considered as a replacement for the Tyrone operation if economic conditions are suitable in the early 1990's.

SEVERANCE TAX ON METALLIFEROUS MINERALS

Background

Laws of 1982, Chapter 230, repealed the tax on sales of metalliferous minerals and enacted a severance tax in its place. Under the provisions of the severance tax, metalliferous minerals were to be taxed at the time of production, not at the time of sale. All metalliferous minerals produced after 1982 were to be taxed on the greater of the following 2 values:

1. The "weighted mineral value" which is essentially the cost of extracting the minerals from the earth and delivering them to the site where they will be processed, or

2. A specified percentage of the old sales tax base.

The severance tax was to be levied on metalliferous minerals at a rate of 2 1/2 percent. Unless otherwise provided by law, the tax was to be administered in the same manner as the sales tax. As a result, severance tax payments were due on the first day of the second month following the month in which the tax accrued. From January 1, 1983 through June 30, 1983, 40 percent of the severance tax was to be distributed in the same manner as the transaction privilege tax (i.e. 25 percent to the cities, 33.6 percent to the counties and 41.4 percent to the state). In subsequent fiscal years, a progressively larger share of the severance tax was to be distributed in the same manner as the transaction privilege tax. The balance of severance tax collections, after making this distribution, was to be deposited each year in the state's general fund. (Effective from and after December 31, 1982.)

Laws of 1983, Chapter 4 changed the due date for payment of the Severance Tax to the twentieth day of the month following the month in which the tax accrues. Taxes were to be delinquent if not received by the Department of Revenue on the day preceding the last day of the month in which they were due. (Effective April 1, 1983). The law also changed the interest rate on delinquent tax payments to equal the rate established by Section 6621 of the Internal Revenue Code, compounded annually. (Effective February 11, 1983.)

Legal Citation

A.R.S. 42-1461 - 42-1466.

Paid by

Persons engaged in the business of extracting substances from the earth that become metalliferous minerals (A.R.S. 42-1461 - 42-1462.)

Exemptions

None.

Tax Base

The severance tax is levied on the "net severance base" of all metalliferous minerals produced after 1982 (42-1462). The "net severance base" is the greater of the following 2 values (42-1464, Laws of 1982, Chapter 230, Section 12):

1. The "weighted mineral value", or

2. A specified percentage of the old sales tax base (the gross value of production less out-of-state processing costs). This value will be referred to as the "Arizona value" after June 30, 1985.

The "weighted mineral value" is essentially the cost of extracting the minerals from the

earth and delivering them to the site where they will be processed.

The "weighted mineral value" is determined using the following formula (42- 1464):

$$\text{weighted mineral value} = \frac{\text{mining costs}}{\text{total production costs}} \times \text{gross value of production}$$

where:

- mining costs represent the cost of extracting the minerals from the earth and delivering them to the site where they will be processed further (42-1461).

- total production costs include most of the major costs incurred in mining and processing minerals until the point of sale (42-1461).

- gross value of production is determined by multiplying the recoverable units of a metallic product by the per unit price of the product; the price per unit does not include the cost of manufacturing, fabricating or otherwise transforming a refined mineral product, when these activities occur prior to sale of the product (42-1461).

Although metalliferous minerals will no longer be taxed on the old sales tax base, the value of minerals produced after 1982 may not fall below a specified percentage of the old tax value (42-1464, Laws of 1982, Chapter 230, Section 12). The old tax value included not only the cost of extracting the minerals from the earth, but most of the major in-state costs of producing the minerals. This value was determined by multiplying the recoverable units of a metallic product by the per unit price and deducting the out-of-state processing costs from the result (42-1464; Laws of 1982, Chapter 230, Section 12; 41-1461). The following table shows the minimum percentage of the old tax value that may be assigned to minerals for severance tax purposes (42-1464; Laws of 1982, Chapter 230, Section 12):

Period during which minerals are produced	Minimum value of minerals for purposes of determining the severance tax
Jan. 1, 1983 - June 30, 1983	100% of the old taxable sale value
July 1, 1983 - June 30, 1984	831/3% of the old taxable sale value
July 1, 1984 - June 30, 1985	66 2/3% of the old taxable sale value
July 1, 1985 and thereafter	50% of the old taxable sale value

Tax Rate

During fiscal years 1980-81, 1981-82 and 1982-83, businesses that produced mineral products were permitted to claim a tax credit against the Special Excise Tax for Education. The tax credit was determined by formula (see "TAX CREDIT" under "SPECIAL EXCISE TAX FOR EDUCATION"). The tax credit could not exceed the taxpayer's Special Excise Tax liability for the year. However, if a taxpayer had an unused amount of credit for any year in which his production was curtailed due to economic conditions, the unused credit could be carried forward for a period not to exceed three years. Since the Special Excise Tax does not apply to metalliferous minerals after December 31, 1982, businesses that produce metalliferous minerals are authorized to claim this tax credit against their severance tax liability, beginning in 1983. In 1982-83, the amount of credit claimed may not exceed 40 percent of the taxpayer's severance tax liability

(Laws of 1982, Chapter 228, Section 2, Laws of 1982, Chapter 230, Section 15).

Due Date

Collections from the severance tax on metalliferous minerals are due on the twentieth day of the month following the month in which the tax accrues. Taxes are delinquent if they are not received by the Department of Revenue on the day preceding the last day of the month in which they are due. The due date may be extended by the Department of Revenue for good cause, but not beyond the first day of the third month following the regular due date (42- 1465, 42-1322).

Collecting Agency

Department of Revenue. (42-1462, 42-101)

Dedication or Purpose

To aid in defraying the necessary and ordinary expenses of the state, cities, and counties to reduce or eliminate the annual tax levy on property for state, city and county purposes and to reduce the levy on property for public school education (Laws of 1982, Chapter 230, Section 17).

Yield

No monies will be collected from this tax until fiscal year 1982-83.

Distribution

Each year, a portion of severance tax collections will be distributed in the same manner as the transaction privilege tax (i.e. 25 percent to the cities, 33.6 percent to the counties and 41.4 percent to the state). The portion of collections that is distributed in this manner will increase each fiscal year until 1986-87. The table below shows the amount of severance tax collections that will be distributed in the same manner as transaction privilege taxes during each fiscal year (42-1465, Laws of 1982, Chapter 230, Section 16).

Period during which collections are received	Portion of severance tax collections distributed in the same manner as the transcation privilege tax
January 1, 1983 - June 30, 1983	40%
July 1, 1983 - June 30, 1984	48%
July 1, 1984 - June 30, 1985	60%
July 1, 1985 and thereafter	80%

After making this distribution the balance of severance tax collections will be deposited each year in the state's general fund and is appropriated for public educational purposes (42-1465; Laws of 1982, Chapter 230, Section 16).

Source: State of Arizona Tax Handbook - 1983

Prepared by the Staff of the Joint Legislative Budget Committee

PROPERTY TAX

The following has been excerpted from "**Appraisal Manual for Mines and Natural Resources**" by Donald E. Ross of the Arizona Department of Revenue which was effective as of January 1, 1988 and is revised annually.

The Natural Resource Unit of the Division of Property Valuation and Equalization is assigned the responsibility of valuing producing and nonproducing mines and oil, gas, and geothermal interests. Arizona Department of Revenue mine valuation regulations R15-4-201 through R15-4-206 are incorporated into this manual.

Arizona Revised Statutes (ARS Section 42-201.8) states:

"Producing mine or mining claim" means any mine or mining claim from which any coal, mineral or mineral substance, other than clay, sand, gravel, building stone or any mineral substance normally processed into artificial stone, has been extracted for commercial purposes at any time during a period of one year prior to the first Monday in January of the tax year."

A producing mine includes the land utilized for mining purposes together with structures and facilities necessary to sustain mining operations. It also includes equipment used directly in the process of extracting ores or minerals from the earth for commercial purposes, including equipment required to prepare the materials for extraction and the handling, loading or transportation of such extracted material to the surface. Mining includes underground, surface and open-pit operations for the extraction of ores and minerals.

If mining operations cease, real and personal property associated with a mining operation will continue to be valued by Centrally Valued Properties for a period of three years. The nonoperating mine will be retained in the legal class 1 for the first year after mining operations are terminated. The legal class designation used for the next two years will depend on the use of the property, which could be class 4 if the property remains idle.

Three years after mining operations have ceased, the valuation of the nonproducing mining property will be transferred from the Centrally Valued Properties' jurisdiction to the Locally Valued Properties' jurisdiction. From this point on, the county assessor is responsible for classifying and valuing the subject property. Such property will be classified according to its current use. If the real and/or personal property is idle at the expiration of the three-year period, it normally will be classified legal Class Four property.

The Natural Resource Unit of the Centrally Valued Properties Section of the Arizona Department of Revenue is responsible for determining annually the value of all producing mines as of the first day of January of the tax year. Property within the context of a producing mine excludes manufacturing operations such as a rod plant. In summary, the value of taxable producing mine property for Arizona property tax purposes includes land, supplies inventories, ore reserves, construction work in progress, personal property and improvements.

Summary of Procedures

Producing mines are taxed on the basis of their assessed value multiplied by the local tax rate which produces the tax due. The

assessment ratio for 1988 is 28% of the full cash value or market value. The full cash value is determined by the mineral property appraiser after correlating the three approaches to value, namely the income, cost and market approaches.

The income approach consists of discounting two different future income streams as developed by (1) the mining company and (2) by the Department utilizing a single rate factor. The Department has developed a method in which a five-year history, expressed as a profit margin, is combined with the future production schedule to produce a future income stream. The historical data are expressed on a production basis, not on a sales basis. This five-year margin method avoids the problems of predicting the future price of copper and other metals. It is supported in the literature and has been approved by the Arizona Supreme Court. The past is only a valid indicator of the performance level of a relatively stable operation and should not be used for new or dying mines. The historical data are averaged to flatten the effects of the peaks and it is generally accepted as standard for financial reporting, and the Securities and Exchange Commission reports.

Cost approach values are determined by computing the reproduction cost new less depreciation for the physical assets. Straight line deprecations is utilized along with appreciation or inflation factors as developed by the Department (Table I). Economic and functional obsolescence can be allowed for by the appraiser if warranted.

Comprehensive field notes are written for each mine annually. contacts with the mining industry are maintained in order to keep abreast of development in technology and discount rates. Technical papers and literature are collected, indexed, and placed in the listing of references for each mine appraisal report. Detailed production statistics are maintained in order to analyze the historical performance for the mine.

TABLE I

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1988

COMPANY/MINE	TONS COPPER ORE MINED	TONS COPPER ORE MILLED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS WASTE/OVERBURDEN REMOVED
ASARCO, INC.					
Mission Unit					
Sulphide	10,181,000	10,181,000	130,364,000		20,570,000
Ray Unit					
Sulphide	9,478,000	9,478,000	157,141,000		26,439,000
Oxide	3,091,000				
Heap Leach/SX-EW			57,506,000		
Dump Leach/SX-EW			19,460,000		
Silver Bell Unit					
Dump Leach/Cementation			8,660,000		
Total	**22,750,000**	**19,659,000**	**373,131,000**		**47,009,000**

(continued)

TABLE I (CONT'D)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1988

COMPANY/MINE	TONS COPPER ORE MINED	TONS COPPER ORE MILLED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS WASTE/OVERBURDEN REMOVED
CYPRUS MINERALS CO.					
Bagdad					
Sulphide	22,100,000	21,500,000	181,500,000	6,400,000	43,200,000
Dump Leach/SX-EW			19,100,000		
Casa Grande					
In Situ/SX-EW			4,300,000		
Miami *(1*					
Oxide	5,851,000				11,025,000
Heap Leach/SX-EW *(2*			52,549,000		
Dump Leach/Cementation			5,538,000		
Mineral Park					
Dump Leach/Cementation *(3*			4,500,000		
Sierrita					
Sulphide	31,977,000	31,837,000	166,603,000	17,354,000	21,328,000
Dump Leach/SX-EW			8,556,000		
Twin Buttes *(4*					
Sulphide	357,000	294,000	11,784,000	81,000	12,362,000
Total	**60,285,000**	**53,631,000**	**454,430,000**	**23,835,000**	**87,915,000**

(1 Production from 7/1/88 through 12/31/88. Acquired from Inspiration Consolidated Copper Co., July 1, 1988.
(2 Although some of this production is from old dumps, it is undifferentiated and is reported as heap leach to be consistent with previous reports.
(3 Includes production from rubblized pit slopes.
(4 Began production in June, 1988.

(continued)

TABLE I (CONT'D)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1988

COMPANY/MINE	TONS COPPER ORE MINED	TONS COPPER ORE MILLED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS WASTE/OVERBURDEN REMOVED
INSPIRATION CONSOLIDATED COPPER CO.					
Inspiration Area Mines *(1*					
Oxide	5,580,000				11,970,000
Heap Leach/SX-EW *(2*			49,142,000		
Dump Leach/Cementation			8,064,000		
Total	**5,580,000**		**57,206,000**		**11,970,000**
KOCIDE MINING CORP.					
Van Dyke *(1*					
In Situ/Cementation			67,000		
Total			**67,000**		

(1 Production from 1/1/88 through 6/30/88. Sold to Cyprus, July 1, 1988.
(2 Although some of this production is from old dumps, it is undifferentiated and is reported as heap leach to be consistent with previous reports.

(1 Started production in December, 1988.

(continued)

TABLE I (CONT'D)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1988

COMPANY/MINE	TONS COPPER ORE MINED	TONS COPPER ORE MILLED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS WASTE/OVERBURDEN REMOVED
MAGMA COPPER CO.					
Pinto Valley Division					
Sulphide	22,432,000	22,429,000	133,686,000	1,026,000	31,131,000
In Situ/SX-EW (Miami)			9,800,000		
Dump Leach/SX-EW (PV)			13,613,000		
San Manuel Division					
Sulphide (UG)	16,091,000	16,072,000	183,042,000	3,241,000	Block Caving
Oxide (OP)	7,194,000	17,000	220,000		18,367,000
Heap Leach/SX-EW			59,817,000		
In Situ/SX-EW			3,139,000		
Total	**45,717,000**	**38,518,000**	**403,317,000**	**4,267,000**	**49,498,000**
PHELPS DODGE CORP.					
Copper Queen Branch					
Dump Leach/Cementation			2,700,000		
Morenci Branch *(1*					
Sulphide	40,929,000	40,923,000	485,835,000	1,030,000	46,305,000
Dump Leach/SX-EW			100,530,000		
Dump Leach/Cementation			7,896,000		
Total	**40,929,000**	**40,923,000**	**596,961,000**	**1,030,000**	**46,305,000**

(1 Includes Sumitomo's 15%.

(continued)

TABLE I (CONT'D)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES

1988

	TONS COPPER ORE MINED	TONS COPPER ORE MILLED	POUNDS RECOVERABLE COPPER	POUNDS RECOVERABLE MOLYBDENUM	TONS WASTE/OVERBURDEN REMOVED
Totals					
Sulphide	153,545,000	152,731,000	1,450,175,000	29,132,000	201,335,000
Oxide (Leach)	21,716,000				41,362,000
Heap Leach/SX-EW			219,014,000		
Dump Leach/SX-EW			161,259,000		
Dump Leach/Cementation			37,358,000		
In Situ/SX-EW			17,239,000		
In Situ/Cementation			67,000		
Sub Total					
SX-EW			397,512,000		
Leached			434,937,000		
GRAND TOTAL	175,261,000	152,731,000	1,885,112,000	29,132,000	242,697,000

Source: Personal correspondence with individual companies.

TABLE II

ARIZONA LEACH COPPER PRODUCTION (1

(Thousand Pounds)

MINE OPERATION	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
ASARCO INCORPORATED										
Silver Bell	6,980	4,423	7,950	8,687	10,374	9,152	8,800	6,814	12,800	8,660
Ray (2	26,502	25,875	25,788	22,420	20,033	20,457	23,706	56,639	68,543	76,966
CYPRUS MINES CORPORATION										
Bagdad	14,337	12,668	13,244	13,173	13,282	14	14,259	13,958	16,470	19,100
Bluebird (3	10,955	13,017	13,328	NR	--	--	--	--	--	--
Casa Grande (4	--	--	26,071	45,611	3,244	15,401	13,514	7,100	4,145	4,300
Johnson	10,032	10,302	10,693	9,702	--	8,803	6,200	--	--	--
Miami (5	16,638	28,958	50,532	50,000	78,988	79,549	85,136	98,747	105,555	115,293
Mineral Park (6	3,348	3,690	4,194	3,191	3,101	2,718	3,798	4,251	4,405	4,500
Ox Hide (5	1,178	1,015	761	1,572	--	--	--	--	--	--
Sierrita/Esperanza (6	6,002	9,991	11,566	9,354	6,367	8,500	10,000	8,770	7,943	8,556
Twin Buttes (7	70,343	63,719	67,922	60,796	50,649	50,239	19,824	--	--	--
KOCIDE MINING CORPORATION										
Van Dyke	--	--	--	--	--	--	--	--	--	67
MAGMA COPPER COMPANY										
Copper Cities	4,351	3,984	3,622	2,046	--	--	--	--	--	--
Pinto Valley/Miami	12,636	11,184	15,736	26,958	24,632	25,602	23,947	22,252	22,724	23,413
San Manuel (8	--	--	--	--	--	--	--	21,923	51,278	62,956
PHELPS DODGE CORPORATION										
Copper Queen Branch	7,316	6,052	4,600	4,545	5,200	3,493	4,144	3,454	2,730	2,700
Morenci Branch	93,983	86,840	96,090	75,735	69,158	60,312	53,228	56,261	45,249	108,426
New Cornelia Branch	--	--	--	661	--	920	402	--	--	--

(continued)

TABLE II (CONT'D)

ARIZONA LEACH COPPER PRODUCTION *(1*

(Thousand Pounds)

MINE OPERATION	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
RANCHERS										
Old Reliable	1,005	1,128	149	--	--	--	--	--	--	--
TOTALS	285,606	282,846	352,246	334,451	285,028	285,160	266,958	300,169	341,842	434,937
PERCENT OF PRIMARY COPPER PRODUCED *(9*	13.3	16.4	15.0	19.6	18.8	18.0	15.0	17.1	19.8	23.1

(1 Copper recovered by precipitation or by solvent extraction from material dump, heap, vat or in situ leached.
(2 Asarco purchased Ray Unit from Kennecott, November 18, 1986.
(3 Operated by Ranchers, became part of Inspiration Area Mines, July, 1984 and Cyprus Miami, July, 1988.
(4 Hecla Lakeshore through 3/31/79; Noranda Lakeshore through 6/31/87; Now Cyprus Casa Grande.
(5 Sold by Inspiration to Cyprus, July 1, 1988.
(6 Cyprus purchased Sierrita/Esperanza and Mineral Park from Duval, April 1, 1986.
(7 Operated by ANAMAX. Acquired by Cyprus, March, 1988.
(8 Open Pit, Heap Leach, SX-EW start-up in spring of 1986. Some In Situ test production.
(9 Leach Copper compared to total copper produced as reported in this report, Table I.

Source: Arizona Department of Mines and Mineral Resources; This report, Table I-II

TABLE III

RANK OF ARIZONA'S COPPER COMPANIES

BY PRODUCTION OF COPPER AND MOLYBDENUM

1988

Copper			Molybdenum		
Rank	Company	% of AZ Production	Rank	Company	% of AZ Production
1	Phelps Dodge Corp. 596,961,000	31.7	1	Cyprus Minerals Co. 23,835,000	81.8
2	Cyprus Minerals Co. 454,430,000	24.1	2	Magma Copper Co. 4,267,000	14.7
3	Magma Copper Co. 403,317,000	21.4	3	Phelps Dodge Corp. 1,030,000	3.5
4	Asarco Inc. 373,131,000	19.8			
5	Inspiration Cons. 57,206,000	3.0			
6	Kocide Mining Corp. 67,000	0.0			
Total	1,885,112,000	100.00		29,132,000	100.00

TABLE IV

RANK OF ARIZONA'S COPPER MINES

BY PRODUCTION OF COPPER AND MOLYBDENUM

1988

Copper			Molybdenum		
Rank	Mine/Company Copper Produced, lb.	% of AZ Production	Rank	Mine/Company Moly Produced, lb.	% of AZ Production
1	Morenci/Phelps Dodge 594,261,000	31.5	1	Sierrita/Cyprus 17,354,000	59.6
2	San Manuel/Magma 246,218,000	13.1	2	Bagdad/Cyprus 6,400,000	22.0
3	Ray/Asarco 234,107,000	12.4	3	San Manuel/Magma 3,241,000	11.1
4	Bagdad/Cyprus 200,600,000	10.7	4	Morenci/Phelps Dodge 1,030,000	3.5
5	Sierrita/Cyprus 175,159,000	9.3	5	Pinto Valley/Magma 1,026,000	3.5
6	Pinto Valley/Magma 157,099,000	8.3	6	Twin Buttes/Cyprus 81,000	0.3
7	Mission/Asarco 130,364,000	6.9			
8	Miami/Inspiration-Cyprus 115,293,000	6.1			
9	Twin Buttes/Cyprus 11,784,000	0.6			
10	Silver Bell/Asarco 8,660,000	0.5			
11	Mineral Park/Cyprus 4,500,000	0.3			
12	Casa Grande/Cyprus 4,300,000	0.2			
13	Copper Queen/Phelps Dodge 2,700,000	0.1			
14	Van Dyke/Kocide 67,000	0.0			
Total	1,885,112,000	100.00		29,132,000	100.00

TABLE V
ARIZONA MINE PRODUCTION
OF RECOVERABLE COPPER IN SHORT TONS

	1984		1985		1986		1987		1988	
	AMOUNT	CHANGE	AMOUNT	CHANGE	AMOUNT	CHANGE	AMOUNT	CHANGE	AMOUNT	CHANGE
BY MONTH										
JANUARY	68,096	0.4%	72,508	6.5%	78,138	7.8%	71,816	(8.1)%	77,612	8.1%
FEBRUARY	62,432	9.8	67,823	8.6	67,524	(0.4)	65,448	(3.1)	73,465	12.2
MARCH	66,058	0.4	76,717	16.1	72,834	(5.1)	72,674	(0.2)	82,552	13.6
APRIL	61,076	(0.2)	75,928	24.3	70,306	(7.4)	67,637	(3.8)	76,379	12.9
MAY	66,125	4.9	76,690	16.0	73,446	(4.2)	69,843	(4.9)	78,766	12.8
JUNE	71,133	9.8	70,816	(0.4)	72,747	2.7	68,985	(5.2)	75,847	9.9
JULY	70,235	29.9	72,534	3.3	74,009	2.0	68,090	(8.0)	77,771	14.2
AUGUST	70,019	35.8	74,134	5.9	71,488	(3.6)	69,596	(2.6)	83,767	20.4
SEPTEMBER	69,528	8.3	70,732	1.7	72,402	2.4	69,498	(4.0)	79,223	14.0
OCTOBER	73,316	15.8	74,081	1.0	76,159	2.8	71,478	(6.1)	81,452	14.0
NOVEMBER	73,541	6.3	73,129	(0.6)	70,220	(3.6)	75,349	7.3	79,210	5.1
DECEMBER	68,901	4.8	78,987	14.6	70,635	(10.6)	76,930	8.9	84,305	9.6
				CUMULATIVE YEAR TO DATE						
JANUARY	68,096	0.4	72,508	6.5%	78,138	7.8%	71,816	(8.1)%	77,612	8.1%
FEBRUARY	130,528	4.7	140,331	7.5	145,662	3.8	137,264	(5.8)	151,077	10.1
MARCH	196,586	3.2	217,048	10.4	218,496	0.7	209,938	(3.9)	233,629	11.3
APRIL	257,662	2.4	292,976	13.7	288,802	(1.4)	277,575	(3.9)	310,008	11.7
MAY	323,787	2.9	369,666	14.2	362,248	(2.0)	347,418	(4.1)	388,774	11.9
JUNE	394,920	4.1	440,482	11.5	434,995	(1.2)	416,403	(4.3)	464,621	11.6
JULY	465,155	7.3	513,016	10.3	509,004	(0.8)	484,493	(4.8)	542,392	12.0
AUGUST	535,174	10.3	587,150	9.7	580,492	(1.1)	554,089	(4.5)	626,159	13.0
SEPTEMBER	604,702	10.1	657,882	8.8	652,894	(0.8)	623,587	(4.5)	705,382	13.1
OCTOBER	678,018	10.7	731,963	8.0	729,053	(0.4)	695,065	(4.7)	786,834	13.2
NOVEMBER	751,559	10.2	805,092	7.1	799,273	(0.7)	770,414	(3.6)	866,044	12.4
DECEMBER	820,460	9.7	884,079	7.7	869,908	(1.6)	847,344	(2.6)	950,349	12.2
AVERAGE MONTH	**68,372**	**9.7%**	**73,673**	**7.7%**	**72,492**	**(1.6)%**	**70,612**	**(2.5)%**	**79,196**	**12.2%**

NOTE: Percentage change column shows change from corresponding period in prior year. Parentheses indicate a negative change.

Source: U.S. Department of the Interior, Bureau of Mines
Prepared By: State of Arizona Joint Legislative Budget Committee

TABLE VI

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
ASARCO INCORPORATED											
Mission *(1*	Sulfide	0.60	0.75	0.75	(0.75)	(0.75)	(0.75)	0.65	0.70	0.67	0.73
Pima *(1*	Sulfide	0.46	0.49	0.49	0.48	--	-	--	--	--	--
Ray Unit *(2 (3*	Sulfide	0.88	0.91	0.97	0.80	1.19	1.13	0.99	0.99	0.89	1.00
	Oxide (Silicate)	--	--	--	--	--	--	1.17	1.23	1.15	1.11
Sacaton	Sulfide	0.68	--	--	--	--	--	--	--	--	--
San Xavier *(1*	Sulfide	0.80	0.65	0.65	(0.65)	(0.51)	(0.51)	--	--	--	--
CYPRUS MINES CORPORATION											
Bagdad	Sulfide	0.50	0.50	0.50	0.50	0.50	0.45	0.44	0.45	0.48	0.45
Bluebird *(4*	Oxide	0.40	0.40	0.40	--	--	--	--	--	--	--
Christmas (OP) *(5*	Sulfide	0.74	0.73	0.62	--	--	--	--	--	--	--
Esperanza *(6*	Sulfide	--	0.32	0.29	0.29	--	--	--	--	--	--
Johnson	Oxide	0.40	0.40	0.40	0.40	0.40	0.71	--	--	--	--
Lakeshore	Oxide	--	--	1.00	1.00	(1.00)	(1.00)	--	--	--	--
Miami *(5*	Sulfide	0.85	0.58	0.58	0.58	0.53	0.55	0.60	0.54	--	--
	Oxide	--	--	--	--	--	0.50	0.49	0.57	0.59	0.52
Mineral Park *(6*	Sulfide	0.24	0.24	0.32	--	--	--	--	--	--	--
Sierrita *(6*	Sulfide	0.34	0.34	0.30	0.30	(0.30)	0.34	0.33	0.34	0.33	0.30
Twin Buttes *(7*	Sulfide	0.94	0.82	0.74	0.78	0.57	--	--	--	--	3.39
	Oxide	1.27	1.26	1.20	1.06	0.93	0.86	0.84	--	--	1.22
MAGMA COPPER COMPANY											
Pinto Valley	Sulfide	0.49	0.49	0.46	0.46	--	0.44	0.45	0.45	0.36	0.37
San Manuel	Sulfide	0.63	0.65	0.64	0.66	0.64	0.64	0.61	0.62	0.62	0.63
	Oxide	--	--	--	--	--	--	--	0.58	0.64	0.61
Superior	Sulfide	4.41	4.32	4.48	4.32	--	--	--	--	--	--

(continued)

TABLE VI (CONT'D)

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

MINE OPERATION		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
PHELPS DODGE CORPORATION											
Metcalf	Sulfide	0.78	0.69	--	0.78	--	--	--	--	--	--
Morenci (8	Sulfide	0.71	0.82	0.74	0.72	0.73	0.81	0.86	0.84	0.82	0.88
New Cornelia	Sulfide	0.53	0.51	0.50	0.64	0.60	0.55	--	--	--	--
WEIGHTED AVERAGE SULFIDE GRADE		0.64	0.58	0.58	0.59	0.65	0.70	0.62	0.61	0.58	0.60

( ) Percentage in parenthesis is approximate: not used in calculation of weighted average.

(1 Combined as Mission Complex in 1985.

(2 Ray Unit acquired from Kennecott, November 18, 1986.

(3 Grade reported for Ray Unit is an average of oxide and sulfide together through 1982.

(4 Bluebird property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, March, 1988.

(5 Acquired from Inspiration, July 1, 1988.

(6 Sierrita, Esperanza and Mineral Park acquired from Duval Corp., April 1, 1986.

(7 Included ANAMAX share of Palo Verde deposit for 1979-1982. Acquired by Cyprus, March, 1988.

(8 Combined Metcalf and Morenci mines production in 1983 et seq.

(9 Weighted average grade of ore milled, based generally on an assay of total copper.

Source: Company annual reports, Form 10-K's and Prospectus; Personal correspondence and Arizona Department of Mines and Mineral Resources.

TABLE VII

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES

(Percent of Total Copper)

MINE OPERATION		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
ASARCO INCORPORATED											
Mission *(1*	Sulfide	75	87	94	85	80	(80 est)	92	91	89	87
Pima *(1*	Sulfide	76	84	76	89	--	--	--	--	--	--
Ray *(2*	Sulfide	--	--	70	70	(70 est)	83	81	82	84	83
Silver Bell	Sulfide	78	--	--	--	--	--	--	--	--	--
San Xavier *(1*	Sulfide	82	66	76	78	79	(80 est)	--	--	--	--
CYPRUS MINES CORPORATION											
Bagdad	Sulfide	82	76	94	83	83	92	91	93	90	91
	Oxide	--	--	--	--	--	52	51	54	42	46
Bluebird *(3 (4*	Oxide	36	41	156	--	--	--	--	--	--	--
Christmas (OP) *(6*	Sulfide	--	70	71	--	--	--	--	--	--	--
Esperanza *(5*	Sulfide	--	90	87	--	--	--	--	--	--	--
Johnson	Oxide	79	86	86	--	62	(62 est)	--	--	--	--
Miami *(7*	Mixed	53	81	74	68	86	80	76	66	69	N/A
Mineral Park *(5*	Sulfide	73	84	75	--	--	--	--	--	--	--
Sierrita *(5*	Sulfide	87	86	80	98 (?)	(88 est)	89	92	91	89	87
Twin Buttes *(8*	Sulfide	85	87	85	--	--	--	--	--	--	87
	Oxide	78	76	77	87	(80 est)	80	(80 est)	--	--	--
MAGMA COPPER COMPANY											
Pinto Valley	Sulfide	84	83	94	95	--	88	80	84	82	84
San Manuel	Sulfide	83	95	87	89	86	90	90	90	85	86
Superior	Sulfide	91	95	93	(93 est)	--	--	--	--	--	--
PHELPS DODGE CORPORATION											
Metcalf	Sulfide	59	58	--	--	--	--	--	--	--	--
Morenci *(9*	Sulfide	68	64	69	68	71	70	86	76	74	72
New Cornelia	Sulfide	80	79	78	85	78	76	--	--	--	--

(continued)

TABLE VII (CONT'D)

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES

(Percent of Total Copper)

(1 Combined as Mission Complex in 1985.

(2 Ray Unit acquired from Kennecott, November 18, 1986.

(3 Bluebird property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, July 1, 1988.

(4 Recovery by leaching heaps continued after mining was terminated, July, 1981.

(5 Sierrita, Esperanza, and Mineral Park acquired from Duval Corp., April 1, 1987.

(6 Acquired from Inspiration, July 1, 1988.

(7 Percent recovery by leaching since 1986. Acquired from Inspiration, July 1, 1988.

(8 Recovery includes ANAMAX's share of Palo Verde 1979-1981-1982-1983-1984. Acquired by Cyprus, March, 1989.

(9 Includes Metcalf production since 1985.

TABLE VIII

STRIPPING RATIOS AT ARIZONA OPEN PIT COPPER MINES *(1*

(Waste:Ore)

MINE OPERATION	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
ASARCO INCORPORATED										
Eisenhower *(2 (3*	--	--	0.71:1	0.67:1	0.57:1	1.26:1	--	--	--	--
Mission *(3*	0.76:1	3.05:1	2.01:1	1.62:1	2.52:1	1.32:1	0.74:1	0.84:1	1.05:1	2.02:1
Pima *(3*	5.20:1	6.28:1	3.06:1	1.42:1	--	--	--	--	--	--
Ray *(4*	2.70:1	3.15:1	1.88:1	2.30:1	2.72:1	2.11:1	2.27:1	2.12:1	1.99:1	2.10:1
Sacaton	3.10:1	2.02:1	1.30:1	0.70:1	0.35:1	0.10:1	--	--	--	--
San Xavier *(3*	1.10:1	6.01:1	6.18:1	2.90:1	0.96:1	1.97:1	--	--	--	--
Silver Bell	1.50:1	--	1.41:1	--	1.09:1	1.17:1	--	--	--	--
CYPRUS MINES CORPORATION										
Bagdad	1.80:1	1.52:1	1.78:1	1.45:1	1.53:1	0.94:1	0.42:1	0.54:1	0.77:1	1.96:1
Bluebird *(5 (6*	1.50:1	1.50:1	0.003:1	--	--	--	--	--	--	--
Christmas *(7*	--	4.40:1	3.24:1	--	--	--	--	--	--	--
Esperanza *(8*	1.30:1	0.76:1	1.95:1	--	--	--	--	--	--	--
Johnson	1.30:1	2.01:1	1.52:1	--	0.03:1	--	--	--	--	--
Miami *(7*	3.40:1	2.40:1	1.53:1	1.42:1	0.27:1	1.72:1	1.50:1	1.82:1	2.04:1	2.01:1
Mineral Park *(8*	1.70:1	1.71:1	1.44:1	--	--	--	--	--	--	--
Sierrita *(8*	1.10:1	1.11:1	0.98:1	0.55:1	0.33:1	0.76:1	0.55:1	0.19:1	0.40:1	0.67:1
Twin Buttes *(9*	2.90:1	3.32:1	3.62:1	2.05:1	1.14:1	--	--	--	--	34.60:1
MAGMA COPPER COMPANY										
San Manuel Oxide	--	--	--	--	--	--	--	1.70:1	2.46:1	2.32:1
Pinto Valley	1.80:1	1.07:1	1.77:1	1.80:1	--	0.79:1	1.01:1	1.21:1	1.32:1	1.39:1
PHELPS DODGE CORPORATION										
Metcalf	2.30:1	1.67:1	--	--	--	--	--	--	--	--
Morenci *(10*	1.40:1	1.30:1	1.63:1	0.79:1	0.64:1	0.90:1	0.68:1	0.76:1	1.10:1	1.13:1
New Cornelia	1.00:1	2.27:1	0.48:1	1.21:1	0.30:1	0.58:1	--	--	--	--
WEIGHTED AVERAGE*	**1.75:1**	**1.90:1**	**1.57:1**	**1.31:1**	**0.57:1**	**1.10:1**	**0.88:1**	**0.96:1**	**1.21:1**	**1.49:1**

TABLE VIII (CONT'D)

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES *(1*

(Waste:Ore)

(1 Leachable rock included with waste (except at solely leach operations).
(2 Mining was done by ASARCO, includes ANAMAX's share of ore.
(3 Combined as Mission Complex in 1985.
(4 Ray Unit acquired from Kennecott, November 18, 1986.
(5 Stripping of overburden ceased in January 1981, but mining continued until July.
(6 Bluebird Property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, July 1, 1988.
(7 Acquired from Inspiration, July 1, 1988.
(8 Sierrita, Esperanza and Mineral Park acquired from Duval, April 1, 1986.
(9 Acquired by Cyprus, March, 1988.
(10 Combined Morenci and Metcalf 1984-1985.

Source: "Minerals Yearbook - Area Reports: Domestic", U.S. Bureau of Mines; Company Annual Reports; E&MJ International Directory of Mining and Mineral Processing Operations; Arizona Department of Mines & Mineral Resources; Company submitted data beginning in 1985.

***NOTE:** These are now weighted averages so use caution in making comparisons to the averages presented in previous editions of this report prior to 1981.

TABLE IX

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER

RECOVERED FROM COPPER ORE

Year	Copper Ore Tons	Gold Troy Ounces Value (3	Silver Troy Ounces Value (4	Molybdenum (1 1,000 lbs. Value (in $1,000)	Copper (2 Pounds Value	Copper (2 Lbs. Cu/ton ore Ave. /lb. (5	Value of Copper Gold, Silver & Molybdenum
1972	165,914,825	102,526	6,614,957	27,126	1,695,858,000	10.22	
		5,987,518	11,143,226	46,791	858,392,446	50.617	922,314,190
1973	181,311,945	102,376	7,164,988	37,657	1,735,012,000	9.57	
		10,013,397	18,325,173	59,372	1,021,314,814	58.865	1,109,025,384
1974	178,913,296	90,206	6,308,721	28,346	1,609,808,000	9.00	
		14,488,424	29,701,332	57,067	1,233,901,735	76.649	1,335,158,491
1975	168,750,152	82,759	6,190,805	25,030	1,502,978,000	8.91	
		13,364,751	27,354,196	61,411	954,917,072	63.535	1,057,047,019
1976	194,136,559	97,961	7,308,395	31,073	1,912,430,000	9.85	
		12,276,473	31,816,805	89,148	1,316,210,823	68.824	1,449,452,101
1977	168,641,401	87,874	6,696,415	34,574	1,705,240,000	10.11	
		13,032,593	30,957,660	120,497	1,122,184,339	65.808	1,166,295,089
1978	178,204,491	92,508	6,611,781	33,029	1,817,670,000	10.20	
		17,905,108	35,709,502	150,142	1,190,755,617	65.510	1,244,520,369
1979	203,977,408	99,549	7,454,306	35,101	1,914,501,095	9.39	
		30,622,766	82,699,941	213,065	1,767,735,441	92.334	2,094,081,895
1980	169,650,401	71,533	5,640,703	36,299	1,521,850,812	8.97	
		43,814,606	116,376,559	324,150	1,543,400,219	101.416	2,027,741,384
1981	216,787,430	95,496	7,565,368	35,600	2,143,898,000	9.89	
		43,891,299	79,575,340	273,052	1,795,385,941	83.744	2,191,904,580

(continued)

TABLE IX

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER RECOVERED FROM COPPER ORE

Year	Copper Ore Tons	Gold Troy Ounces Value (3	Silver Troy Ounces Value (4	Molybdenum (1 1,000 lbs. Value (in $1,000)	Copper (2 Pounds Value	Copper (2 Lbs. Cu/ton ore Ave. /lb. (5	Value of Copper Gold, Silver & Molybdenum
1982	146,124,870	61,050	6,301,000	22,099	1,697,500,000	11.62	
		22,949,000	50,090,000	100,673	1,261,415,000	74.31	1,435,127,000
1983	152,902,150	61,991	4,492,000	23,934	1,495,208,000	9.78	
		26,284,000	51,383,000	79,459	1,144,285,000	76.53	1,301,411,000
1984	145,278,431	51,548	4,093,000	23,184	1,582,549,000	10.89	
		18,591,200	33,320,000	78,827	1,044,483,000	66.00	1,175,151,000
1985	159,547,970	52,053	4,885,000	30,428	1,778,334,456	11.14	
		16,585,000	30,007,000	98,827	1,166,571,000	65.60	1,311,990,000
1986	153,439,000	63,334	4,202,000	29,382	1,752,525,000	11.42	
		23,370,000	22,987,000	75,607	1,157,543,000	66.05	1,279,507,000
1987	166,113,000	48,430	3,530,000	15,939	1,724,068,000	10.38	
		21,694,000	24,745,000	51,802	1,370,924,000	79.52	1,469,165,000
1988	175,261,000	93,000 (e	3,181,000 (p	29,132	1,885,112,000	10.76	
		40,641,000	20,832,000	78,074	2,243,283,000	1.19	2,382,830,000

(1 Molybdenum content of recovered concentrate.
(2 Excludes precipitate copper from dump and in-place leaching prior to 1982.
(3 At average annual domestic, free market gold price.
(4 At E&MJ average annual N.Y. market price for .999 fine silver.
(5 At E&MJ average annual price, U.S. Producer Cathode Preliminary.
(e Estimated
(p Preliminary.

Source: Table I, this publication - U.S. Bureau of Mines State Mineral Summaries.

TABLE X

NONFUEL MINERAL PRODUCTION IN ARIZONA *(1*

Mineral	1987 Quantity	1987 Value (thousands)	1988 *(p* Quantity	1988 *(p* Value (thousands)
Clays ----------thousand short tons--	219	$1,905	205	$1,823
Copper (recoverable content of ores, etc.) ----metric tons--	764,148	1,389,771	868,878	2,298,655
Gem stones ----------	NA	3,000	NA	3,300
Gold (recoverable content of ores, etc.) ------troy ounces--	95,240	42,663	156,005	68,486
Gypsum ----------thousand short tons--	W	W	W	W
Lime ----------thousand short tons--	546	21,932	647	25,998
Molybdenum ----------thousand pounds--	W	W	53,359	144,069
Perlite ----------short tons--	49	1,361	W	W
Pumice ----------thousand short tons--	1	7	1	7
Sand and gravel (construction) ----------do-------	38,100 *(e*	140,300	37,000	136,200 *(e*
Silver (recoverable content of ores, etc.) thousand troy ounces--	3,667	25,706	3,181	20,832
Stone (crushed) ----------thousand short tons--	7,712	33,999	6,600 *(e*	29,300 *(e*
Combined value of cement, diatomite (1988), pyrites (1987-88), salt, sand and gravel (industrial), stone (dimension 1986, 1988), and values indicated by symbol W ----------	XX	129,398	XX	100,517
Total ----------	XX	1,791,042	XX	2,829,187

(e Estimated.
(p Preliminary.
NA Not available.
W Withheld to avoid disclosing company proprietary data; value included in "Combined value" figure.
XX Not applicable.
(1 Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Source: "The Mineral Industry of Arizona in 1988" Mineral Industry Surveys, U.S. Bureau of Mines.

TABLE XI
ESTIMATED
COPPER MINE CAPACITY IN ARIZONA *(1*
(Short tons of Recoverable Copper/Year)

OPERATOR	MINE	CAPACITY *(2*
Phelps Dodge	Morenci/Metcalf	300,000 *(a*
Magma	San Manuel	130,000 *(a*
Cyprus	Sierrita/Esperanza	120,000 *(b*
Asarco	Ray	115,000 *(c*
Cyprus	Bagdad	100,000 *(a*
ASARCO	Mission Complex	87,000 *(c*
Magma	Pinto Valley	85,000 *(a*
Cyprus	Inspiration Area	62,000 *(c*
Magma	Superior	42,000 *(d*
Phelps Dodge	New Cornelia	40,000 *(d*
Cyprus	Mineral Park	17,000 *(d*
Magma	Miami & Miami Tails	14,000 *(a(b*
Cyprus	Christmas	8,000 *(d*
ASARCO	Silverbell	4,000 *(e*
Kocide	Van Dyke	3,000 *(b*
Cyprus	Casa Grande	2,000 *(e*
Phelps Dodge	Copper Queen	2,000 *(e*
TOTAL		1,131,000

(1 Figures generally represent a current estimate of the productive capacity of primary recoverable copper in concentrates, precipitates, and cathodes. Figures do not represent smelter or refinery capacity. The estimates are based on recent production figures and on capacities of concentrator and leach plant facilities. Other factors affecting actual production include, for example, grade of ore and recovery. Some capacities have been published by the reporting company. Capacities for shut down operations are historic and not necessarily immediately available.

(2 Basis of capacity estimate
(a Recent production figures
(b Design capacity & ore grade
(c Company annual report or 10K
(d Historic data
(e Leaching only

Source: Arizona Department of Mines & Mineral Resources file data; Company Annual Reports and Form 10-K; Professional Publications.

TABLE XII

COPPER SMELTERS
North America
End of 1988-Short Tons

Company	Location Of Plant	Annual Capacity
	United States	
ASARCO Incorporated		
El Paso Smelter	El Paso, TX	450,000
Hayden Smelter	Hayden, AZ	720,000
Hayden-Ray Smelter	Hayden, AZ	360,000
BP Minerals America		
Kennecott Utah Copper	Garfield, UT	820,000
Chemetco Inc.	Alton, IL	150,000
Copper Range Company	White Pine, MI	70,000
Cyprus Miami Mining Corporation	Claypool, AZ	408,000
Magma Copper Company San Manuel Division	San Manuel, AZ	1,026,000
Phelps Dodge Corporation		
Chino Mines	Hurley, NM	550,000
Tyrone Branch	Playas, NM	750,000
Total (a)		5,304,000
	Canada	
Falconbridge Ltd.	Falconbridge, Ont.	700,000
Gaspe Mines	Murdochville, Que.	357,000
Hudson Bay Mining and Smelting Co., Ltd.	Flin Flon, Manitoba	340,000
Inco Ltd.	Copper Cliff, Ont.	1,800,000
Noranda Mines Inc.		
Gaspe Smelter	Murdochville, Que.	357,000
Horne Smelter	Rouyn-Noranda, Que.	1,000,000
Total (a)		4,554,000
	Mexico	
Cia. Minera De Santa Rosalia, S.A.	Santa Rosalia, Baja, CA	100,000
Compania Minera De Cananea, S.A.	Cananea, Son.	277,000
Industrial Minera Mexico, S.A.	San Luis Potosi	42,000
Mexicana De Cobre, S.A. De C.V.	Nacozari, Sonora	672,000
Total (a)		1,091,000

The capacity of copper smelting works is given as estimated by the respective proprietors.
(a) Tons of material.

Source: American Bureau of Metal Statistics Inc.

TABLE XIII

COPPER PRODUCTION BY COMPANIES (g
Short Tons

	1984	1985	1986	1987	1988
Anaconda Copper Company (own mines) (d	14,933	--	--	--	--
Anamax Mining Company	25,709	9,864	--	--	--
ASARCO Incorporated	103,710	85,470	98,268	194,682	206,000
BP Minerals America (U.S. mines) (l	303,000	235,000	190,000	60,000	245,000
Cominco American Incorporated And Dresser Minerals (e	1,045	1,192	1,892	1,925	1,671
Copper Range Company (f	24,761	--	31,298	53,053	45,802
Cyprus Bagdad Copper Corp.	23,876	83,671	86,920	91,340	100,298
Cyprus Casa Grande Corp. (m	--	--	--	879	2,150
Cyprus Johnson Copper Company	4,401	3,100	2,436	--	--
Cyprus Miami Mining Corp. (o	--	--	--	--	30,658
Cyprus Mineral Park Corp.	--	--	--	2,203	2,214
Cyprus Pinos Altos Corp.	--	--	--	130	4,189
Cyprus Sierrita Corporation	92,204	110,690	56,089	78,985	87,579
Cyprus Tonapah	--	--	--	--	144
Cyprus Twin Buttes	--	--	--	--	6,010
The Doe Run Company	--	--	--	13,018	22,936
Hecla Mining Company (a	742	749	346	289	481
Coeur Mine (j	61	61	62	58	47
Galena Mine (k	172	154	141	121	125
Lucky Friday Mine	442	534	143	110	309
Sunshine Mine	67	--	--	--	--
Inspiration Consolidated Copper Company (f	44,112	40,402	32,085	35,582	(p
Magma Copper Company (n	120,345	108,642	112,513	197,013	200,753
Pinto Valley Division	56,507	90,839	97,544	75,550	78,550
San Manuel Division	120,345	108,642	112,513	121,463	122,203
Montana Resources	--	--	8,876	30,856	53,155
Noranda Lakeshore Mines, Inc. (b	7,701	6,779	3,581	--	--
Phelps Dodge Corporation (U.S. mines) (b	331,232	410,076	405,400	468,900	451,800
Tennessee Chemical Company	9,245	8,450	7,475	4,560	--

(a Includes Hecla's share of production from each mining property.
(b Includes copper produced from purchased ores.
(d Includes Anaconda's 50% share of Anamax Mining Company.
(e Magmont mine.
(f Refined production.
(g Copper content of mine production unless otherwise noted.
(j Operated by ASARCO - Shows Hecla Mines share of 5%.
(k Operated by ASARCO - Shows Hecla Mines share of 25%.
(l Reported production of refined copper plus unrefined copper sales. Includes only BP Minerals America's share from jointly owned properties.
(m Formerly Noranda Lakeshore.
(n Refined copper contained in concentrates produced and SX-EW production.
(o Formerly Inspiration Consolidated Copper Company.
(p Starting in 1988, Cyprus Miami Mining Corp.

Source: American Bureau of Metal Statistics Inc.

TABLE XIV

Copper Imports Of The United States By Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Ore, Matte & Regulus	**17,075**	**7,710**	**5,977**	**12,765**	**10,796**
Canada	4,084	2,820	2,147	4,093	351
Mexico	249	19	--	6,753	7,346
Honduras	254	83	--	--	--
Argentina	--	--	18	--	--
Bolivia	--	--	--	7	15
Chile	2,597	77	71	--	34
Peru	1,175	1,265	1,431	1,474	566
Venezuela	--	664	--	--	--
Japan	218	524	639	--	--
Philippines	6,313	--	--	--	--
Australia	1,998	2,150	1,671	438	475
Papua New Guinea	--	--	--	--	2,009
Other Countries	187	108	--	--	--
Blister Copper	**66,340**	**28,635**	**51,049**	**47,991**	**141,608**
Canada	5	2,559	3,248	15	20
Mexico	7,610	2,117	20,068	15,457	45,002
Chile	51,555	19,823	27,409	21,532	44,330
Peru	6,902	3,819	--	2,921	3,282
Germany, F.R.	76	72	269	95	--
Ireland, Rep. of	--	--	--	--	1
Italy	--	--	--	--	446
Switzerland	--	--	--	--	543
Japan	--	--	--	2,189	32,151
Namibia (S.W. Africa)	--	--	--	--	561
South Africa	--	--	--	5,782	9,815
Zaire	--	--	--	--	3,258
Zambia	--	--	55	--	--
Australia	--	--	--	--	2,199
Other Countries	192	245	--	--	--
Refined Cathodes & Shapes	**555,968**	**415,675**	**541,990**	**556,973**	**421,428**
Canada	202,957	141,085	219,969	231,078	197,999
Mexico	--	1,780	1,419	611	46
Brazil	--	--	--	--	1,319
Chile	169,826	167,548	164,436	159,915	116,428
Peru	58,509	38,714	59,035	46,716	21,185
Austria	--	--	--	--	494
Belgium	13,359	5,865	2,386	702	4,393
Germany, F.R.	441	1,209	--	34,680	8,329
Netherlands	80	--	--	7,043	11,273
Norway	1,959	886	--	205	389
Spain	--	--	--	--	6,677
Sweden	--	--	--	16,788	8,021
Switzerland	--	--	--	--	385
United Kingdom	41	3,541	6,381	--	--
Yugoslavia	--	--	--	4,629	2,199
Hong Kong	--	--	--	--	710

(continued)

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Japan	4,163	5,241	--	661	--
South Korea	910	2,393	--	--	--
Philippines	1,050		--	--	--
Taiwan	--	--	--	300	--
Congo (Brazzaville)	--	--	3,155	--	--
South Africa	555	6,453	11,101	5,046	1,984
Zaire	30,907	30,057	39,688	26,446	35,144
Zambia	64,501	9,821	32,714	21,834	--
Australia	3,270	8	--	--	--
Poland	--	--	--	--	2,967
China	--	--	--	165	844
Other Countries	3,218	912	1,706	154	642
Waste & Scrap (unalloyed)	**25,362**	**25,368**	**29,984**	**36,510**	**40,952**
Waste & Scrap (alloyed)	**34,267**	**25,591**	**31,635**	**36,528**	**39,516**
Copper in Rolls, Sheets or Rods	**43,007**	**41,870**	**41,473**	**33,510**	**38,373**
Canada	12,014	14,202	10,386	12,466	11,146
Mexico	11	134	--	137	4,101
Argentina	--	--	--	100	142
Brazil	3,792	2,333	2,454	1,338	2,085
Chile	1,949	1,486	7,277	2,666	2,841
Peru	662	909	619	747	293
Belgium	169	1,068	880	104	20
Finland	2,715	2,208	2,180	3,087	4,402
France	1,916	1,808	704	75	60
Germany, F.R.	10,020	7,451	6,468	3,466	4,022
Italy	1,401	975	907	391	61
Netherlands	50	129	210	308	309
Sweden	2,408	3,151	2,843	1,572	2,789
United Kingdom	166	135	312	258	216
Yugoslavia	433	696	479	311	673
Japan	4,604	3,559	3,664	4,408	4,132
South Korea	--	--	538	213	196
South Africa	143	412	528	14	41
Zaire	--	--	--	550	--
Australia	264	154	535	1,211	655
Other Countries	225	1,022	489	88	189
Copper Seamless Tube & Tubing	**32,694**	**32,398**	**42,485**	**49,416**	**45,961**
Canada	5,767	5,502	6,490	6,451	5,298
Mexico	3,281	955	6,496	12,180	14,673
Brazil	707	224	--	120	400
Chile	151	297	400	315	759
Finland	714	970	236	265	111
France	183	219	446	416	134
Germany, F.R.	729	837	702	603	685
Italy	--	--	289	1,476	1,922

(continued)

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Sweden	--	--	--	115	122
United Kingdom	164	126	295	187	209
Japan	20,394	22,833	26,514	27,016	21,244
Other Countries	598	428	617	272	404
Brass Rods, Sheets, Plates, Bars & Strip	**93,024**	**68,028**	**63,946**	**54,430**	**51,352**
Canada	5,572	3,482	2,292	3,823	3,403
Mexico	1,234	190	1,503	4,513	4,432
Argentina	329	695	2,163	1,680	2,722
Brazil	15,101	8,929	7,098	2,985	4,374
Peru	--	--	--	484	234
Belgium	404	409	--	225	--
Denmark	--	--	--	256	75
France	12,363	6,081	5,400	3,249	2,070
Germany, F.R.	26,906	18,575	16,390	10,785	11,631
Italy	3,182	3,591	2,592	1,449	1,029
Netherlands	6,728	5,449	5,048	5,918	5,312
Sweden	607	1,808	774	718	1,680
Switzerland	1,432	1,789	2,428	2,422	2,806
United Kingdom	1,403	686	456	892	2,041
Yugoslavia	2,306	1,557	1,590	1,749	1,460
Israel	1,322	1,141	1,095	1,064	1,157
Japan	7,059	7,481	8,771	7,880	1,114
South Korea	--	--	3,618	444	557
South Africa	1,188	648	630	444	1,138
New Zealand	--	--	--	399	475
Hungary	796	539	684	1,442	949
Poland	--	--	--	1,156	1,886
China	--	--	--	104	309
Other Countries	5,026	4,920	1,414	349	498
Copper & Alloyed Foil *(a*	**39,717**	**33,951**	**31,129**	**37,590**	**33,810**
Canada	7,900	5,763	5,219	6,830	7,377
Belgium	46	--	--	192	18
France	544	36	--	--	--
Germany, F.R.	2,061	1,033	1,057	2,451	473
Ireland, Rep. of	--	--	--	601	--
Netherlands	9,047	8,968	8,978	10,353	9,056
Sweden	13,785	13,732	13,248	14,856	14,266
United Kingdom	2,488	631	518	437	645
Japan	2,533	2,303	1,518	1,727	1,741
Other Countries	1,313	1,485	591	143	234
Brass Seamless Tube & Tubing	**22,798**	**20,212**	**21,171**	**18,786**	**19,043**
Canada	4,303	2,443	1,025	1,154	1,149
Mexico	672	185	918	958	1,399
Brazil	500	359	575	136	674
Chile	--	--	--	90	173

(continued)

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Belgium	--	--	--	59	28
France	77	39	--	--	--
Germany, F.R.	10,457	9,340	9,438	8,545	7,648
Greece	225	116	127	317	517
Italy	504	1,282	1,537	101	127
Netherlands	392	250	--	--	--
Portugal	--	--	164	170	86
Spain	9	2	--	--	--
Switzerland	19	44	--	--	--
United Kingdom	326	211	--	130	226
Yugoslavia	674	592	535	390	283
Israel	270	311	332	364	357
Japan	3,619	3,665	4,049	4,155	3,803
South Korea	459	444	719	479	341
South Africa	4	699	1,289	1,364	1,840
Other Countries	288	230	463	374	392
Copper Alloyed Wire	**5,362**	**4,757**	**8,026**	**8,439**	**9,068**
Copper Wire Insulated *(b*	**68,190**	**83,016**	**95,201**	**103,597**	**106,022**
Canada	36,057	36,393	33,491	34,523	36,111
Mexico	5,592	6,683	10,528	23,276	24,667
Costa Rica	--	--	2,757	2,350	2,516
Brazil	3,893	5,904	4,141	3,157	5,371
Chile	132	918	1,444	829	607
Peru	356	5,251	4,499	3,587	5,443
Venezuela	--	--	3,427	3,276	3,425
France	1,699	2,598	2,538	4,130	2,688
Germany, F.R.	1,127	921	--	1,171	1,172
Italy	2,169	3,111	3,011	1,763	807
Spain	1,025	3,227	4,205	3,728	297
Sweden	49	85	--	--	--
United Kingdom	789	718	--	--	--
Yugoslavia	1,837	2,595	2,898	3,072	4,777
Hong Kong	--	--	--	113	639
Israel	732	810	--	616	663
Japan	3,396	3,149	6,862	4,329	2,547
South Korea	488	3,274	5,797	4,914	6,746
Taiwan	--	--	5,563	7,342	5,998
Other Countries	8,849	7,379	4,040	1,421	1,548

(a Metal weight. (b Gross weight.

Source: American Bureau of Metal Statistics Inc., U.S. Bureau of the Census. Current monthly data available, report 010, for the above table on an annual subscription basis.

TABLE XV

Copper Exports of the United States by Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Ore, Concentrate & Matte	**67,240**	**128,206**	**192,183**	**137,512**	**239,438**
Canada	87	3,050	6,993	2,013	9,367
Mexico	--	--	--	4	2,151
Belgium	212	100	--	--	--
Finland	--	--	5,096	7,968	1,967
Germany, F.R.	1,694	--	--	976	37,051
Netherlands	11	--	--	--	--
Yugoslavia	--	--	--	4,113	--
Israel	2	--	--	--	--
Japan	62,004	113,352	145,103	109,737	149,762
South Korea	3,195	7,628	15,548	5,681	13,225
Philippines	--	--	--	--	3,511
Taiwan	--	4,076	5,505	4,162	3,291
Germany, D.R.	--	--	--	--	8,757
China	--	--	13,771	2,723	10,316
Other Countries	--	--	167	135	40
Blister Copper	**9,237**	**19,817**	**17,598**	**13,600**	**36,023**
Canada	430	408	437	922	10,818
Mexico	47	2,804	--	303	584
Chile	4	--	--	--	--
Austria	556	--	--	--	--
Belgium	784	--	--	--	--
Germany, F.R.	257	100	--	--	5,421
Netherlands	276	--	--	--	--
Portugal	--	--	125	281	--
Spain	--	--	100	5	1,164
United Kingdom	20	--	--	--	--
Hong Kong	213	6	185	784	740
Japan	18	--	776	4,706	--
South Korea	6,480	16,177	14,879	5,122	16,279
Singapore	72	76	94	112	217
Taiwan	84	93	636	521	588
Australia	--	--	139	380	--
Other Countries	100	246	227	464	212
Refined Ingots, Bars, Etc.	**103,532**	**53,037**	**16,446**	**20,304**	**73,269**
Canada	4,513	6,165	5,357	4,943	6,010
Mexico	3,288	12,729	317	4,674	11,894
Dominican Republic	--	--	--	46	--
Brazil	123	53	126	501	61
Venezuela	13	27	149	134	65
Belgium	51	671	--	391	1,902
France	955	318	516	535	1,690
Germany, F.R.	1,401	1,439	1,533	514	1,546
Italy	--	--	--	218	4,989
Netherlands	7,387	19,343	305	276	9,786
Spain	126	2	--	--	--
Sweden	9	76	--	--	--

(continued)

TABLE XV (CONT'D)

Copper Exports of the United States by Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Switzerland	46	40	108	49	145
United Kingdom	1,080	806	2,469	1,185	2,755
Hong Kong	168	1,050	661	458	612
India	32	24	--	61	112
Israel	14	30	--	--	--
Japan	78,568	5,605	--	3,036	15,201
South Korea	1,737	1,146	1,473	2,063	7,833
Malaysia	--	--	--	--	519
Philippines	--	--	--	--	106
Singapore	64	--	--	2	1,411
Taiwan	3,539	1,609	2,835	1,178	2,617
Thailand	--	--	--	--	21
Ghana	--	--	246	--	--
Australia	7	4	--	--	--
China	55	25	--	--	3,905
Other Countries	356	1,875	351	40	89
Copper Waste & Scrap (unalloyed)	89,075	148,040	150,375	119,776	132,025
Canada	12,399	18,277	15,149	12,273	32,159
Mexico	14,915	13,507	6,488	13,533	12,672
Brazil	--	1,875	4,374	3,326	655
Venezuela	--	--	--	217	337
Belgium	2,209	10,383	3,552	2,154	3,100
Finland	--	--	--	97	--
France	57	182	--	--	--
Germany, F.R.	3,270	18,654	9,385	4,774	10,748
Italy	839	7,553	13,585	6,769	920
Netherlands	1,085	4,395	1,887	406	1,019
Norway	--	--	--	--	118
Spain	2,058	5,292	6,191	8,877	3,725
Sweden	487	234	--	--	--
United Kingdom	572	4,303	1,637	822	2,547
Hong Kong	446	1,590	6,312	3,656	1,579
India	1,288	1,102	792	545	2,222
Japan	16,878	14,829	13,835	17,141	17,780
South Korea	14,528	15,284	13,632	10,650	21,540
Philippines	--	--	--	1,045	--
Singapore	--	1,062	754	1,262	2,313
Taiwan	17,539	27,650	51,694	31,791	17,959
Thailand	8	8	--	--	--
Australia	78	58	--	157	--
China	--	--	--	210	470
Other Countries	419	2,864	1,108	71	162
Copper-Base Alloy, Waste & Scrap (a	115,659	160,791	167,121	204,335	220,405
Canada	33,638	26,421	22,628	23,321	26,023
Mexico	2,655	4,239	935	6,308	11,127
Trinidad	--	--	--	776	1,053

(continued)

TABLE XV (CONT'D)

Copper Exports of the United States by Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Brazil	--	401	4,363	7,037	649
Venezuela	262	374	--	141	165
Austria	--	--	--	310	--
Belgium	3,422	6,960	6,187	8,019	9,607
France	224	227	--	106	770
Germany, F.R.	3,996	18,814	5,325	8,513	23,133
Italy	2,695	9,804	21,608	7,177	2,148
Netherlands	664	4,315	1,644	885	1,229
Spain	1,391	7,638	8,595	6,911	11,132
Sweden	2,821	1,994	2,587	1,763	1,780
Switzerland	513	713	--	180	59
United Kingdom	601	2,296	4,486	2,975	2,974
Yugoslavia	--	132	--	--	--
Hong Kong	258	1,285	--	576	227
India	9,113	15,235	18,254	13,079	14,533
Japan	28,111	27,328	28,317	26,522	18,988
South Korea	8,315	13,692	15,837	28,761	48,550
Philippines	--	--	--	126	--
Singapore	771	344	--	255	1,254
Taiwan	16,023	16,231	24,153	60,326	43,647
China	--	--	--	198	1,146
Other Countries	186	2,749	2,202	70	211
Copper & Alloyed Foil	**327**	**195**	**667**	**1,125**	**2,536**
Canada	114	12	246	532	1,388
Mexico	--	--	--	7	6
Honduras	--	--	25	--	--
Venezuela	--	--	--	181	33
Germany, F.R.	6	6	6	25	73
Italy	--	--	--	4	344
Netherlands	--	--	4	2	4
Sweden	--	--	--	1	21
United Kingdom	--	--	7	19	5
Bahrain	--	--	3	--	--
Hong Kong	--	--	62	--	111
India	--	--	6	--	--
Japan	11	22	8	8	83
South Korea	5	6	7	76	131
Kuwait	--	--	31	--	--
Qatar	--	--	--	36	--
Saudi Arabia	--	--	--	7	--
Singapore	--	--	5	--	--
Taiwan	171	76	121	173	306
Thailand	--	--	13	11	6
United Arab Emirates	--	--	115	31	--
New Zealand	--	--	--	3	--
Other Countries	20	73	8	9	25
Pipes & Tubes	**4,270**	**5,004**	**5,890**	**7,128**	**8,541**

(continued)

TABLE XV (CONT'D)

Copper Exports of the United States by Countries
Copper Content-Short Tons

	1984	1985	1986	1987	1988
Plates & Sheets	5,122	866	708	594	951
Unalloyed Copper Bars, Angles, Shapes, Sections & Rods	13,338	7,396	9,848	15,611	20,085
Wire & Cable, Bare	9,677	8,775	7,915	11,237	13,692
Insulated Wire & Cable *(b*	65,136	54,754	65,217	95,211	128,633
Building Wire & Cable	3,879	2,265	2,924	2,852	3,245
Power Wire & Cable	6,622	6,852	6,338	13,610	10,250
Communication Wire & Cable	21,211	13,489	21,304	30,108	46,625
Copper Magnet Wire	3,589	2,905	2,279	3,244	4,774
Appliance Wire & Cord	4,511	5,950	6,311	5,189	8,323
Other Insulated Wire & Cable	25,324	23,293	26,061	40,208	55,416
Blister Copper *(c*	--	7	4	--	10
Refined Copper *(c*	2,006	16,736	692	11	2,261
Canada	9	12	27	--	--
Mexico	1,005	--	--	--	--
Brazil	--	369	--	--	--
Germany, F.R.	--	--	--	11	201
Netherlands	--	10,148	--	--	2,060
Japan	551	--	--	--	--
South Korea	--	--	665	--	--
Taiwan	441	--	--	--	--
China	--	6,207	--	--	--

(a Metal weight. (b Gross weight. (c Re-exports, imported foreign merchandise.

Source: American Bureau of Metal Statistics Inc., U.S. Bureau of the Census. Current monthly data available, report 011, for the above table on an annual subscription basis.

TABLE XVI

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

Year	Average No. Covered Employees (1	Total Wages	Average Annual Wage	Average Weekly Wage	Tons Copper Ore
1948	11,493	41,318,524	3,595	69.13	39,072,204
1949	11,001	40,612,224	3,692	71.00	37,365,611
1950	10,181	41,994,321	4,125	79.33	41,757,273
1951	10,754	47,825,698	4,447	85.52	42,784,388
1952	11,365	54,950,235	4,835	93.14	44,472,522
1953	12,068	62,742,982	5,199	99.98	45,187,838
1954	12,502	65,518,853	5,241	100.79	43,072,894
1955	12,399	71,293,263	5,750	110.58	52,189,728
1956	14,008	83,568,996	5,966	114.73	60,468,580
1957	14,652	85,125,320	5,809	111.71	59,571,834
1958	14,100	74,726,972	5,300	101.93	56,255,809
1959	11,568	72,095,130	6,232	119.85	53,121,545
1960	13,764	90,312,848	6,562	126.19	66,032,439
1961	14,275	97,271,286	6,814	131.04	71,918,991
1962	14,408	101,920,108	7,074	136.04	78,868,147
1963	14,303	104,291,588	7,292	140.23	80,615,132
1964	14,720	113,792,031	7,730	148.65	86,132,039
1965	15,239	122,163,124	8,016	154.16	92,859,535
1966	17,018	137,187,611	8,061	155.02	101,558,298
1967	13,426	108,427,206	8,076	155.31	74,289,203
1968	15,734	136,089,579	8,649	166.33	101,293,963
1969	19,459	173,183,018	8,900	171.15	127,848,828
1970	21,479	201,665,064	9,389	180.56	150,241,000
1971	21,231	211,978,597	9,984	192.00	149,294,000
1972	23,233	254,717,341	10,964	210.85	165,914,825
1973	25,494	291,294,328	11,426	218.89	181,311,945
1974	27,894	340,832,096	12,219	234.98	178,913,296

(continued)

TABLE XVI (CONT'D)

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

Year	Average No. Covered Employees (1	Total Wages	Average Annual Wage	Average Weekly Wage	- Tons Copper Ore
1975	25,950	363,349,178	14,002	269.27	168,750,152
1976	25,631	405,289,034	15,812	304.08	194,136,559
1977	23,373	398,539,789	16,835	323.75	168,641,401
1978	21,092	397,790,419	18,860	362.69	178,204,491
1979	23,239	494,963,476	21,299	409.60	203,997,408
1980	21,602	510,168,454	23,617	454.17	169,650,401
1981	26,031	687,434,789	26,408	507.85	216,787,430
1982	17,182	487,415,292	28,368	545.53	135,768,647
1983	13,864	395,266,852	28,510	548.29	135,301,652
1984	12,556	387,028,537	30,824	592.77	145,278,431
1985	11,155	349,311,047	31,314	602.19	174,218,218
1986	10,848	326,915,975	30,136	579.54	167,808,000
1987	10,340	299,297,407	28,946	556.65	166,113,000
1988	10,588	348,502,604	33,008	634.78	175,261,000

(1 "Covered Employment" by law includes all employees of employers of three or more persons. Prior 1966 only a portion of the workers in smelting, refining and rod fabrication were included in this table.

Source: This report, Table XVII; "Mineral Yearbook - Area Reports: Domestic", U.S. Bureau of Mines; Research and Statistics Unit, Arizona Department of Economic Security.

TABLE XVII

ARIZONA INDUSTRIES COVERED BY UNEMPLOYMENT INSURANCE

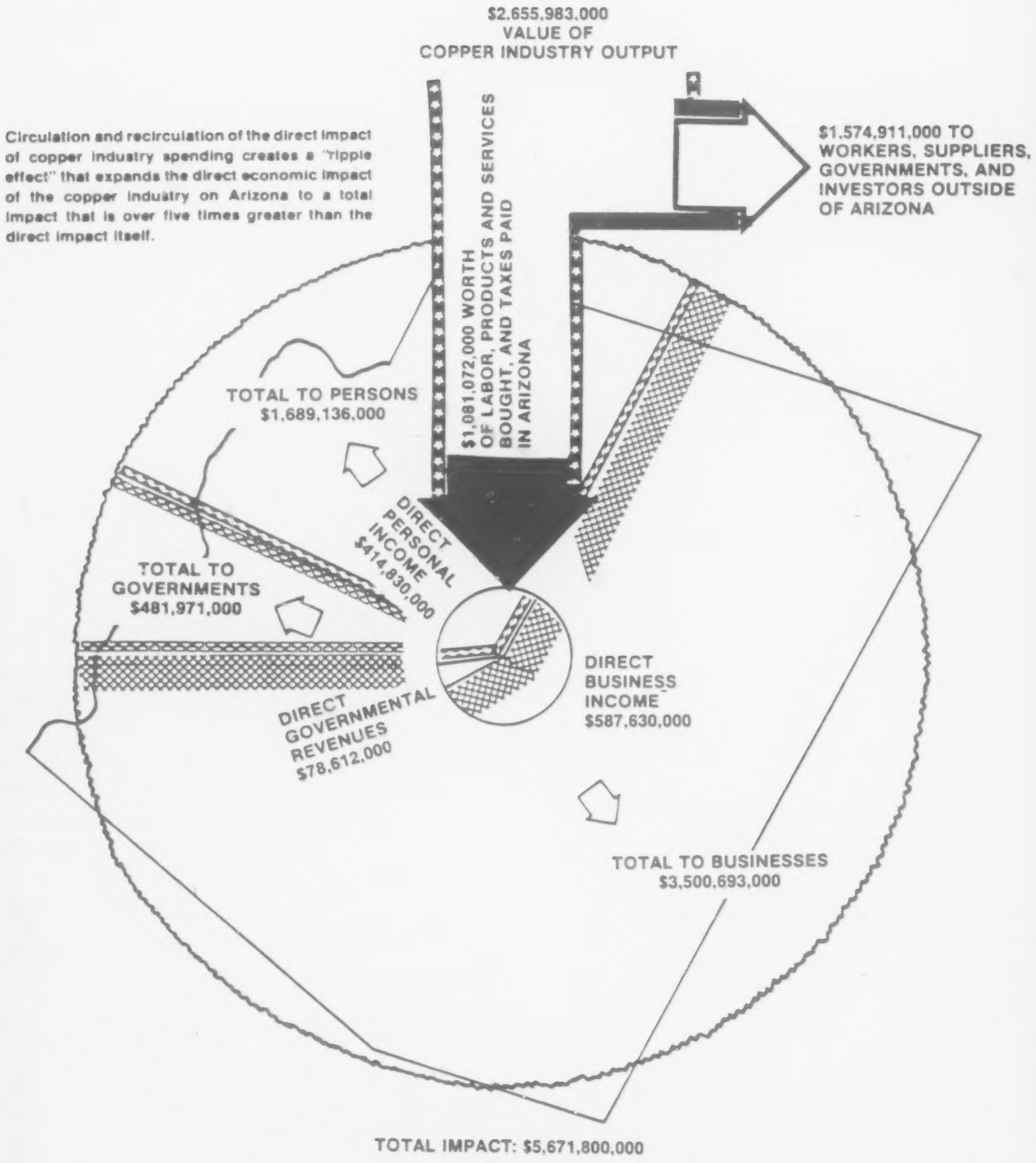
YEAR - 1988

Industry	Average Number of Employees (1	Total Wages	Average Annual Wage	Average Weekly Wage
Copper Mining	8,798	296,158,443	33,662	647.35
Copper Smelting, Refining & Rod Fabrication	1,760	52,344,161	29,741	571.94
TOTAL COPPER MINING & PROCESSING	10,558	348,502,604	33,008	634.78
Other Mining, Quarrying & Processing	3,014	91,007,336	30,195	580.67
ALL MINING, QUARRYING & PROCESSING	13,572	439,509,940	32,384	622.76
Mfg. Except Copper Processing	188,001	4,996,666,166	26,578	511.11
Construction	98,421	2,046,730,518	20,796	399.92
Transportation, Utilities, etc. (2	64,260	1,655,493,366	25,762	495.43
Wholesale-Retail Trade	346,195	4,961,048,264	14,330	275.58
Services, Finance & Misc.	435,325	8,255,063,990	18,963	364.67
Agriculture & Related Services	32,342	378,886,757	11,715	225.29
Federal, State & Local Government	233,477	5,284,207,003	22,633	435.24
TOTAL AND AVERAGES	1,411,593	28,017,606,004	19,848	381.70

(1 Includes all covered employees.
(2 Transportation exclusive of railroads.

Source: Research Administration, Arizona Department of Economic Security

TABLE XVIII


$2,655,983,000
VALUE OF
COPPER INDUSTRY OUTPUT
Circulation and recirculation of the direct impact of copper industry spending creates a "ripple effect" that expands the direct economic impact of the copper industry on Arizona to a total impact that is over five times greater than the direct impact itself.
$1,081,072,000 WORTH OF LABOR, PRODUCTS AND SERVICES BOUGHT, AND TAXES PAID IN ARIZONA
$1,574,911,000 TO WORKERS, SUPPLIERS, GOVERNMENTS, AND INVESTORS OUTSIDE OF ARIZONA
TOTAL TO PERSONS
$1,689,136,000
DIRECT PERSONAL INCOME
$414,830,000
TOTAL TO GOVERNMENTS
$481,971,000
DIRECT BUSINESS INCOME
$587,630,000
DIRECT GOVERNMENTAL REVENUES
$78,612,000
TOTAL TO BUSINESSES
$3,500,693,000
TOTAL IMPACT: $5,671,800,000

DIRECT AND INDIRECT IMPACTS OF THE COPPER INDUSTRY ON THE ARIZONA ECONOMY 1988

Source: "The Copper Industry's Impact on the Arizona Economy 1988" by George F. Leaming, Western Economic Analysis Center, Marana, Arizona

TABLE XIX

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA *(1*

	All Employees		PRODUCTION WORKERS											
	Average No. (Thousands)		Average No. (Thousands)		Average Weekly Earnings		Average Weekly Hours		Average Hourly Earnings		Average Earnings Per Man Per Year		Aggregate Man Hours (Thousands)	
Period	*(2* Ariz.	*(3* U.S.	*(4* Ariz.	U.S.	*(5* Ariz.	U.S.	Ariz.	U.S.	*(6* Ariz.	U.S.	*(7* Ariz.	U.S.	*(8* Ariz.	U.S.
1970	18.8	37.0	14.9	29.5	173.01	175.67	43.8	44.7	3.95	3.93	8,997	9,135	33,936	68,570
1971	18.9	34.7	14.9	26.8	178.50	178.46	42.4	42.9	4.21	4.16	9,282	9,280	32,852	59,785
1972	20.5	38.9	16.1	30.7	194.69	192.19	41.6	41.6	4.68	4.62	10,124	9,994	34,827	66,410
1973	21.5	42.3	17.6	33.7	206.75	206.42	41.6	42.3	4.97	4.88	10,751	10,734	38,072	74,127
1974	24.0	42.8	19.1	33.8	222.16	226.46	39.6	41.1	5.61	5.51	11,552	11,776	39,331	72,237
1975	22.5	37.1	17.9	28.4	247.43	247.14	38.6	39.2	6.41	6.33	12,866	12,903	35,929	57,891
1976	21.7	35.5	17.2	27.0	286.31	280.70	40.1	40.1	7.14	7.00	14,888	14,596	35,865	56,300
1977	19.3	35.1	15.3	26.9	302.99	288.73	39.4	38.6	7.69	7.48	15,755	15,014	31,347	53,994
1978	17.2	35.2	13.7	26.9	344.76	338.40	40.8	40.0	8.45	8.46	17,928	17,597	29,066	55,952
1979	19.3	31.9	15.3	24.6	404.81	405.03	42.3	42.5	9.57	9.53	21,050	21,061	33,654	54,366
1980	17.7	29.4	14.0	22.6	446.19	435.01	41.7	41.0	10.70	10.61	23,202	22,621	30,358	48,183
1981	21.9	36.2	17.4	27.9	497.28	492.54	41.2	41.6	12.07	11.84	25,859	25,612	37,278	60,353
1982	15.2	25.3	12.1	18.5	495.60	484.91	38.3	38.7	12.94	12.53	25,771	25,215	24,098	37,229
1983	11.3	18.9	9.0	13.5	519.25	522.69	39.1	39.9	13.28	13.10	27,001	27,180	18,299	28,010
1984	10.5	16.3	8.2	11.4	553.83	562.74	41.3	41.5	13.41	13.56	28,799	29,002	17,610	24,601
1985	9.4	13.1	7.5	9.4	573.80	574.76	41.4	42.2	13.86	13.62	29,838	29,888	16,146	20,627
1986	8.7	11.4	6.9	8.8	582.38	507.99	40.4	41.3	14.42	12.30	30,284	26,415	14,496	18,899
1987	8.6	13.5	6.9	10.7	556.65	492.20	40.1	43.1	13.88	11.42	28,946	25,595	14,388	23,981
1988	8.8	14.4	7.0	11.2	647.35	510.12	41.3	43.9	12.53	11.62	33,662	26,526	15,033	25,567

(continued)

TABLE XIX (CONT'D)

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA *(1*

	Copper Ore Mined (Thousand Short Tons)		Copper Produced (Recoverable Content) (Thousand Pounds)		Worker Productivity Copper Ore Mined Per Man-Hour (Tons)		Worker Productivity Copper Produced Per Man-Hour (Pounds)	
Period	Ariz.	U.S.	Ariz.	U.S.	Ariz.	U.S.	Ariz.	U.S.
1970	150,241	257,729	1,826,734	3,368,957	4.427	3.759	53.829	49.132
1971	149,294	242,656	1,633,568	2,986,599	4.544	4.059	49.725	49.996
1972	165,815	266,831	1,816,118	3,264,113	4.761	4.017	52.161	49.151
1973	173,605	289,998	1,847,635	3,386,357	4.872	3.912	48.530	45.683
1974	178,821	293,443	1,710,744	3,145,148	4.547	4.062	43.496	43.539
1975	168,656	263,003	1,619,535	2,772,111	4.694	4.543	45.076	47.885
1976	194,046	283,736	2,043,168	3,166,889	5.410	5.040	56.968	56.250
1977	168,601	259,974	1,843,949	2,964,539	5.379	4.815	58.824	54.905
1978	178,201	263,722	1,965,072	2,955,210	6.131	4.713	67.607	52.817
1979	203,977	291,078	2,085,556	3,140,110	6.061	5.369	61.971	57.759
1980	169,650	241,090	1,669,495	2,527,920	5.588	5.004	54.994	52.465
1981	216,787	306,089	2,294,437	3,354,548	5.815	5.072	61.549	55.582
1982	146,125	200,589	1,697,500	2,507,070	6.064	5.388	70.442	67.342
1983	152,902	196,203	1,514,538	2,288,612	8.356	7.005	82.766	81.707
1984	145,278	189,499	1,583,505	2,405,866	8.250	7.703	89.921	97.795
1985	174,218	239,399	1,778,334	2,443,675	10.790	11.606	110.141	118.470
1986	167,808	186,105	1,752,525	2,361,127	11.576	9.847	120.897	124.934
1987	166,113	219,545	1,724,068	2,810,182	11.5[illegible]	9.155	119.827	117.189
1988	175,261	246,380	1,885,112	3,168,229	11.658	9.637	125.398	123.918

(continued)

TABLE XIX (CONT'D)

EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING

IN THE UNITED STATES AND ARIZONA (1

(1 Statistics do not reflect workers in copper smelting, refining and rod fabrication.

(2 These figures are estimates made by the Arizona Department of Economic Security, in cooperation with the U.S Bureau of Labor Statistics, and they include all full and part-time wage and salary workers who were employed in copper mining in any part of the pay periods which included the 12th of each month of the year.

(3 Estimates made by the U.S. Bureau of Labor Statistics, in cooperation with the 50 states, and based upon monthly samplings similar to those in (2 above, adjusted periodically to census bench mark.

(4 Estimates of production (non-supervisory) workers based upon samplings as in (2 above. Since 1975, figures have been calculated by the Arizona Department of Mines and Mineral Resources dividing the annual number of "All Employees-Arizona" by a factor of 1.26. This factor was derived by comparing the annual number of "All Employees-Arizona" with "Production Workers - Arizona" from 1970 to 1974.

(5 Earnings figures for a particular year is the product of "Average Hourly Earnings" and "Average Weekly Hours" for that year.

(6 Gross payroll aggregates, exclusive of irregular bonuses and other pay not earned in a sample pay period, are divided by gross man-hour aggregates of production and related workers for the period in order to determine average hourly earnings.

(7 "Average Weekly Earnings" times 52 weeks.

(8 Number of production workers times "Average Weekly Hours" times 52 weeks.

Source: Table I this publication, American Bureau of Metal Statistics, Research and Statistics Unit, Arizona Department of Economic Security: "Mineral Yearbook - Metals, Minerals", U.S. Bureau of Mines. Employment and Earnings", U.S. Dept. of Labor, Bureau of Labor Statistics, March issues, U.S. Dept. of Interior.

Figure 3. COPPER PRODUCED (RECOVERABLE CONTENT)*

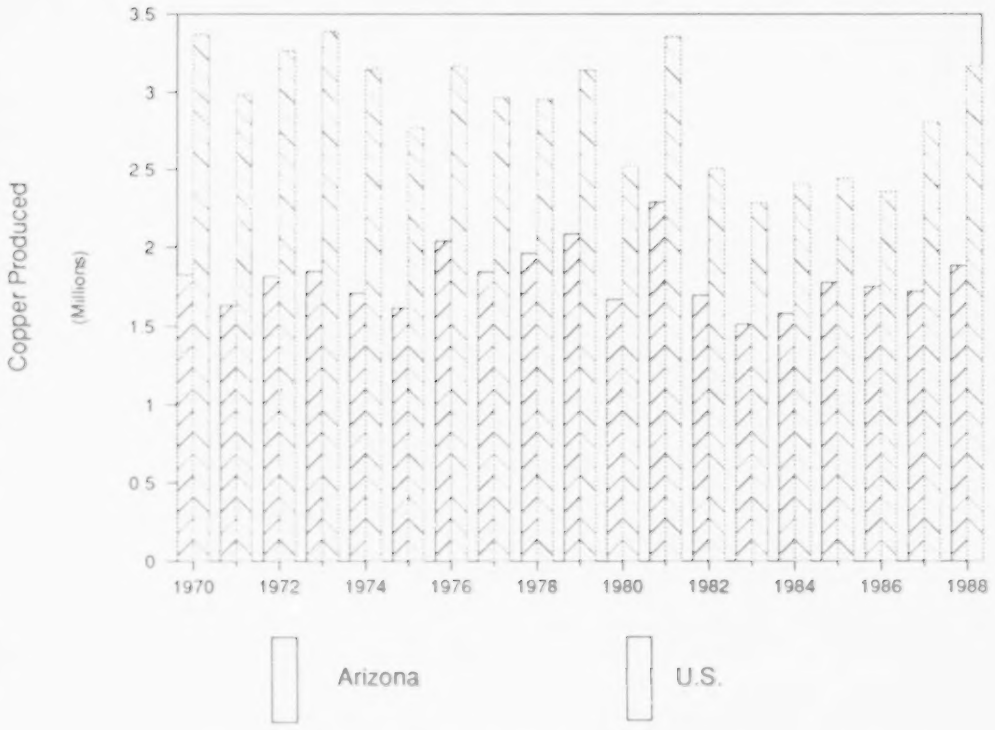
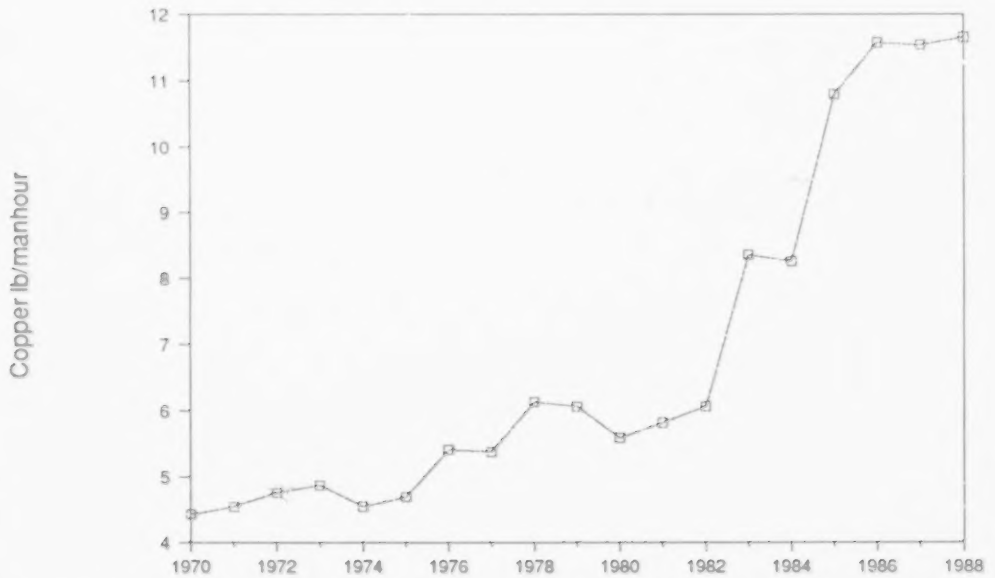


Figure 4. PRODUCTIVITY OF ARIZONA COPPER WORKERS*



* From Table XIX, *Employment, Earnings, and Hours in Copper Mining in the U.S. and Arizona.*

TABLE XX

REFINED COPPER INVENTORIES AT YEAR END
AMOUNTS IN THOUSANDS OF SHORT TONS

Where Held	1983	1984	1985	1986	1987	1988
U.S. refineries	66.1	193.4	150.4	145.1	63.1	33.9 *(a*
Comex warehouses	409.2	276.3	120.3	93.3	18.3	5.9 *(a*
Total U.S.	**475.3**	**469.7**	**270.7**	**238.4**	**81.4**	**39.8** *(a*
Refineries elsewhere	352.6	285.7	293.7	277.1	210.0	219.7 *(b*
LME warehouses	480.2	139.3	209.1	193.1	58.3	78.2 *(b*
Total elsewhere	**832.8**	**425.0**	**502.8**	**470.2**	**268.3**	**297.9** *(b*
Aggregate inventories	**1308.1**	**894.7**	**773.5**	**708.6**	**349.7**	**337.7**

Source: American Bureau of Metal Statistics as reported in E&MJ. All figures for December 31 through 1987.

(a As of November 30, 1988.
(b As of October 31, 1988.

TABLE XXI
AVERAGE QUOTED PRICE OF
ELECTROLYTIC COPPER WIREBAR
DOMESTIC, DELIVERED
U.S. ¢/lb. *(1*

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
JANUARY	76.574	119.385	88.570	78.634	80.219	68.792	64.487	69.881	64.986	132.496
FEBRUARY	89.697	133.808	86.071	78.779	84.024	70.748	66.446	68.253	65.525	105.025
MARCH	96.718	106.040	87.382	75.862	82.072	75.311	65.547	70.144	68.071	109.720
APRIL	98.322	94.851	88.033	76.273	83.493	77.388	70.318	68.801	67.129	103.641
MAY	91.234	93.479	85.798	77.948	85.634	72.229	69.864	67.082	70.985	104.373
JUNE	88.241	92.713	85.226	71.488	81.836	69.849	67.094	67.471	74.346	114.275
JULY	86.768	103.565	84.412	71.053	82.947	64.402	66.773	63.815	80.419	104.848
AUGUST	91.335	100.708	87.387	70.999	80.542	64.535	66.284	62.374	82.183	101.451
SEPTEMBER	95.853	98.864	84.722	71.065	77.587	63.408	65.716	64.844	85.607	116.120
OCTOBER	99.106	99.471	82.312	72.413	73.392	62.039	66.680	63.464	88.253	138.048
NOVEMBER	99.708	96.982	81.216	72.968	69.581	65.650	66.294	62.855	108.528	152.320
DECEMBER	106.448	89.127	80.293	74.230	70.805	63.538	68.025	63.630	133.339	161.270

(1 MW US Producer Delivered.

Source: Metals Week.

Prepared by: State of Arizona Joint Legislative Budget Committee Staff.

TABLE XXII

AVERAGE COPPER CASH PRODUCTION COSTS FOR THE UNITED STATES, 1982-87 *(1*

(Cents per pound of copper)

PRODUCT COSTS	1982	1983	1984	1985 *(6*	1986	1987 *(2*
Mine op. cost	26	22	20	23	23	19
Mill-Float op. cost	24	24	23	20	21	28
Mill-Leach op. cost	9	7	7			
Smelt/Refine/Transportation	28	26	24	23	19	14
Taxes *(3*	3	3	2	2	2	2
Total Cost	**90**	**82**	**76**	**68**	**65**	**63**
Byproduct Credits	(13)	(13)	(11)	(9)	(9)	(10)
Cash Cost *(4*	77	69	65	59	56	53
Recovery of Capital					11	5
TOTAL					**67**	**58**
Production Thousand Short Tons *(5* of Copper	989	1,027	1,203	1,222	1,180	1,504

(e Estimated.
(1 Includes 16 mines, most of which were producing from 1982 to 1987.
(2 Based on life of mine production rates and ore grades.
(3 Property and severance taxes and royalties, if applicable.
(4 Includes all cash cost of production and credit for byproducts but excludes depreciation and profit. Costs are in actual dollars for each year shown.
(5 Based on the production of the 16 mines analyzed. Long run production is estimated full capacity level. Capacities are averaged over the life of the mine.
(6 Includes 13 mines. Mill costs are combined in 1985-7.

Source: U.S. Bureau of Mines Preprint from Bulletin 675 Chapter on Copper. Mineral Facts and Problems, 1985 Edition and the Minerals Yearbooks.

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
ANTLER T17N R16W Sec 4	Standard Metals Corp.	Sulfide	5	1.95	With 4.13% Zn, 0.94% Pb, and 1.05 Ag oz/ton. Annual Report & Form 10-K, 1987. An additional 2.5 million tons reported
ATLAS T11S R8E Sec 32	Asarco	Sulfide	5	0.64	Report on the BS&K Project, Pima Co., AZ" by Frank H. Buchella. Cutoff at 0.40% Cu.
		Acid Soluble	5	0.37	Cutoff at 0.20% Cu.
		Sulfide	19	0.66	Asarco property adjacent to Atlas.
		Acid Soluble	12	0.38	Asarco property adjacent to Atlas.
BAGDAD T14N R9W Sec 4	Cyprus Minerals Co.	Sulfide	606	0.43	With 0.018% Mo. (includes acid soluble) Form 10-K, 1988.
BUCKEYE EAST T3S R12E Sec 26	Asarco Inc.	Acid Soluble	22	0.65	AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress.
CACTUS T1N R13E Sec 36	Magma Copper Co.	Mixed	10	0.70	Cactus Prospect Report. Cutoff at 0.2% Cu.
CARLOTA T1N R13E Sec 36	Owens, S.B.	Acid Soluble	4	0.85	Reported 1979.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA (1

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
CASA GRANDE T6S R5E Sec 18	Asarco Freeport McMoran	Mixed	352	1.00	Getty Oil Co. Annual Report, 1980. With 0.01% Mo. Cutoff at 0.5% Cu.
CHILITO T4S R15E Sec 22	Asarco Inc.	Mixed	75	0.51	Chilito Mines Report. With 0.01% Mo, 0.04 oz Ag.
CHRISTMAS (OP)	Cyprus Minerals Co.	Sulfide	7	0.63	Inspiration Resources Form 10-K, 1983
CHRISTMAS (UG) T4S R16E Sec 30		Sulfide	20	1.82	(same as above)
COCHISE T23S R24E Secs 9 & 10	Phelps Dodge Corp.	Acid Soluble	170	0.50	Annual Report, 1987.
COPPER BASIN T13N R3W Sec 20	Phelps Dodge Corp.	Sulfide	175	0.55	With 0.021% Mo.
COPPER BUTTE T3S R13E Sec 30	Asarco Inc.	Acid Soluble	22	1.09	AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress.
COPPER CREEK T8S R18E Sec 11	Magma Copper Co.	Sulfide	80	0.55	Old copper reserves data.
COPPER QUEEN T23S R24E Sec 9	Phelps Dodge Corp.	Mixed	1	5.50	Underground. Phelps Dodge Prospectus May 8, 1975.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
DOS POBRES T5S R26E Sec 27	Phelps Dodge Corp.	Sulfide	232	0.89	Form 10-K, 1987.
DRAGOON T16S R22E Sec 25	Sullivan, James	Acid Soluble	25	0.50	0.5 to 0.6 acid soluble copper.
DYNAMITE T17S R13E Sec 30	Smith, V.A. - Estate	Mixed	100	0.53	Unpublished estimate.
EMERALD ISLE T23N R18W Sec 22	Arimetco	Acid Soluble	1	0.40	3 million tons at 0.1% Cu USBM RI 8236, Pub. 1977.
ESPERANZA T18S R12E Sec 16	Cyprus Minerals Co.	Sulfide	48	0.27	With 0.034% Mo. Pennzoil Form 10-K, 1981.
FOUR METALS T23S R16E Sec 20	Dore Mining & Milling	Sulfide	3	0.82	Iso Mines Ltd. Annual Report, 1965.
GIBSON T1S R14E Sec 21	Lodestar Minerals Inc.	Acid Soluble	11	0.7	43 million tons at 0.40% Cu. Fletcher, J.B. et al report Aug. 1984.
HELVETIA T18S R15E Sec 36	Asarco Inc.	Sulfide Acid Soluble	337 22	0.54 0.55	With Sulfide - 0.088 oz/ton Ag, 0.0005 oz/ton Au.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
I-10 T15S R23E Sec 31	Cyprus Minerals Co.	Mixed	100	0.52	Unpublished estimate; with 0.02% Mo.
INSPIRATION AREA MINES T1N R14E Sec 25	Cyprus Minerals Co.	Acid Soluble	260	0.44	Cyprus Minerals Co. Form 10K, 1988 Acquired by Cyprus from Inspiration July 1, 1988.
IRON DOOR T13S R25E Sec 17	Unknown	Sulfide	63	0.38	Spike-E Hills Report. Cutoff at 0.20% Cu.
JOHNSON T15S R22E Sec 26	Arimetco	Sulfide	7	0.60	Personal contact - unpublished
		Oxide	3	0.75	
		Oxide	9	0.42	Copper Chief Deposit
KALAMAZOO T9S R16E Sec 9	Magma Copper Co.	Sulfide	211	0.77	Form 10-K, 1987.
		Sulfide shaft pillar	101	0.68	
KORN KOB T12S R17E Sec 14	Keystone Minerals Inc.	Acid Soluble	2	0.53	North Ore Body.
			8	0.44	South Ore Body. Holmes & Narrou report on Korn Kob, March 1974 section 5.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
LAKESHORE T10S R4E Sec 25	Cyprus Minerals Co.	Sulfide (Porphyry)	41	0.71	Noranda Annual Report, 1984.
		Sulfide (Tactite)	9	1.35	Noranda Annual Report, 1984.
		Acid Soluble	16	0.79	Cyprus Minerals Form 10-K, 1988.
LONE STAR T6S R27E Sec 5	Phelps Dodge Corp.	Mixed	1000	0.41	Phelps Dodge Form 10-K, 1988.
MAGMA MINE T1S R12E Sec 35	Magma Copper Co.	Sulfide	4	5.70	Magma Form 10-K, 1988.
MAME T19S R25E Sec 20	Hope Mining & Milling Co.	Acid Soluble	1	1.10	Unpublished estimate.
MIAMI EAST T1N R15E Sec 19	Magma Copper Co.	Sulfide	6	3.14	Newmont Mining Annual Report, 1985.
		Sulfide	50	1.95	Minerals Yearbook 1973, VII Area Rpts USBM
MIAMI TAILINGS T1N R15E Sec 30	Magma Copper Co.	Acid Soluble	35	0.33	Magma Form 10-K, 1988. Expect 54% recovery.
MINERAL BUTTE T4S R7E Sec 1	Berry, Julian	Mixed	15	0.42	Cutoff at 0.32% Cu. Bear Creek report.
MINERAL PARK T23N R17W Sec 19	Cyprus Minerals Co.	Sulfide	35	0.17	With .054% Mo. Pennzoil Form 10-K, 1981.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA (I

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
MISSION COMPLEX T16S R12E Sec 31	Asarco Inc.	Sulfide	358	0.64	With 0.13 oz/ton Ag. Asarco Annual Report, 1988.
MORENCI/METCALF T4S R29E Sec 16	Phelps Dodge 85% & Sumitomo 15%	Sulfide Sulfide	685 226	0.76 0.70	Additional reserve is Sulfide - 226 million tons at 0.7069% Cu. Phelps Dodge Form 10-K, 1988.
NEW CORNELIA T12S R6W Sec 27	Phelps Dodge Corp.	Sulfide	209	0.50	Phelps Dodge Form 10-K, 1988.
ORACLE RIDGE T11S R16E Sec 16	Southern Atlantic Ventures Ltd.	Mixed	11	2.25	AZ Conference AIME Dec. 1977. With 0.64 oz/ton Ag, Copper Studies Inc., NYC March 30, 1979.
PEACH ELGIN T18S R15E Sec 15	Asarco Inc.	Sulfide Acid Soluble	14 10	0.78 0.75	West, Barbara J. report, January 1980.
PINTO VALLEY T1N R14E Sec 2	Magma Copper Co.	Sulfide *Sulfide	404 317	0.39 0.39	Magma Form 10-K, 1988. *Outside of current mine plan.
POSTON BUTTE T4S R9E Sec 33	Conoco Inc.	Mixed	800	0.40	Copper Studies Inc., NYC, March 30, 1979. 500 million tons at 0.50% TCu from Conoco Annual Report, 1972.
RAY T3S R13E Sec 10	Asarco Inc.	Sulfide	660	0.70	Asarco Annual Report, 1988.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA (1

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
RED MOUNTAIN T22S R16E Sec 20	Kerr McGee Corp.	Sulfide	100	0.71	Tucson Daily Citizen, Sept. 23, 1970.
SACATON EAST (UG) T5S R5E Sec 26	Asarco Inc.	Sulfide	15	1.25	Asarco Inc. Form 10-K, 1979.
SAN JUAN T5S R26E Sec 35	Claridge, Alf	Acid Soluble	16	0.52	Cutoff at 0.35% Cu or 20 million tons at lower grade with lower cutoff. Producers Minerals Corp. rpt June 1975.
SAN MANUEL T8S R16E Sec 34	Magma Copper Co.	Sulfide *Sulfide	109 143	0.73 0.64	Magma Form 10-K, 1988. Cutoff at 0.50% Cu. * Not in current mine plan
SAN MANUEL OPEN PIT T8S R16E Sec 35	Magma Copper Co.	Acid Soluble Acid Soluble Acid Soluble	49 11 261	0.42 0.14 0.35	Open Pit. Magma Form 10-K, 1988. Open Pit Marginal. Magma Form 10-K, 1988. In Situ. Magma Form 10-K, 1988.
SANCHEZ T6S R27E Sec 25	Arizona Copper Co.	Acid Soluble	168	0.34	S.W. Pay Dirt, June 1989
SANTA CRUZ T6S R4E Sec 13	Freeport McMoran & Asarco	Acid Soluble	800	0.43	50% joint venture with ASARCO. USBM data 1985.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
SHEEP MOUNTAIN PROPERTY T8N R2W Sec 13	Smith, Ken P. et al	Sulfide	300	1.00	To 400 tons, copper content approx. Unpublished estimate.
SIERRITA T18S R12E Sec 7	Cyprus Minerals Co.	Sulfide	343	0.29	With .037% Mo. Cyprus Minerals Co. Form 10-K, 1988.
SILVER BELL T12S R8E Sec 11	Asarco Inc.	Sulfide	21	0.68	With .07 oz/ton Ag. Asarco Annual Report, 1988.
SQUAW PEAK T13N R5E Secs 29 & 30	Squaw Peak Copper	Sulfide	20	0.36	Roe, Robert R., 1976 report.
STRONG & HARRIS T15S R22E Sec 13	Durham, A. et al	Mixed	60	0.60	Unpublished estimate with 0.70% Zn.
TURQUOISE T19S R25E Sec 17	Santa Fe Mining	Acid Soluble	10	0.50	Pub. 1975 by Union Oil.
TWIN BUTTES T18S R13E Sec 5	Cyprus Sierrita	Sulfide Acid Soluble	39 11	1.00 0.73	Cyprus Minerals Co. Form 10-K, 1988. (same as above)
UNITED VERDE T1N R15E Sec 22	Phelps Dodge	Sulfide	12	0.60	Unpublished estimate.
VAN DYKE T1N R15E Sec 30	Kocide Chemical	Acid Soluble	100	0.50	Mining Engineering, Dec. 1977.

(continued)

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA *(1*

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
VEKOL HILLS T10S R3E Sec 4	Tohono O'odham	Sulfide	105	0.56	With 0.014% Mo, 16 million tons acid soluble Cu. Final EIS, Vekol Hills Project, US Dept of Interior, Bureau of Indian Affairs, May 1988.
VENTURA T23S R15E Sec 1	Cyprus Minerals Co.	Sulfide	6	0.26	Iso Mines Ltd. Annual Report, 1965. With 0.28% MoS (6 million additional tons possible)
WHITE MESA T38N R9E Sec 29	Navajo Tribe	Acid Soluble	2	0.75	Mayo, E.B., 1955 report.
ZONIA T11N R4W Sec 12	Zonia Co.	Acid Soluble	35	0.31	Lundin, Richard J. et al, Feb. 1985 report

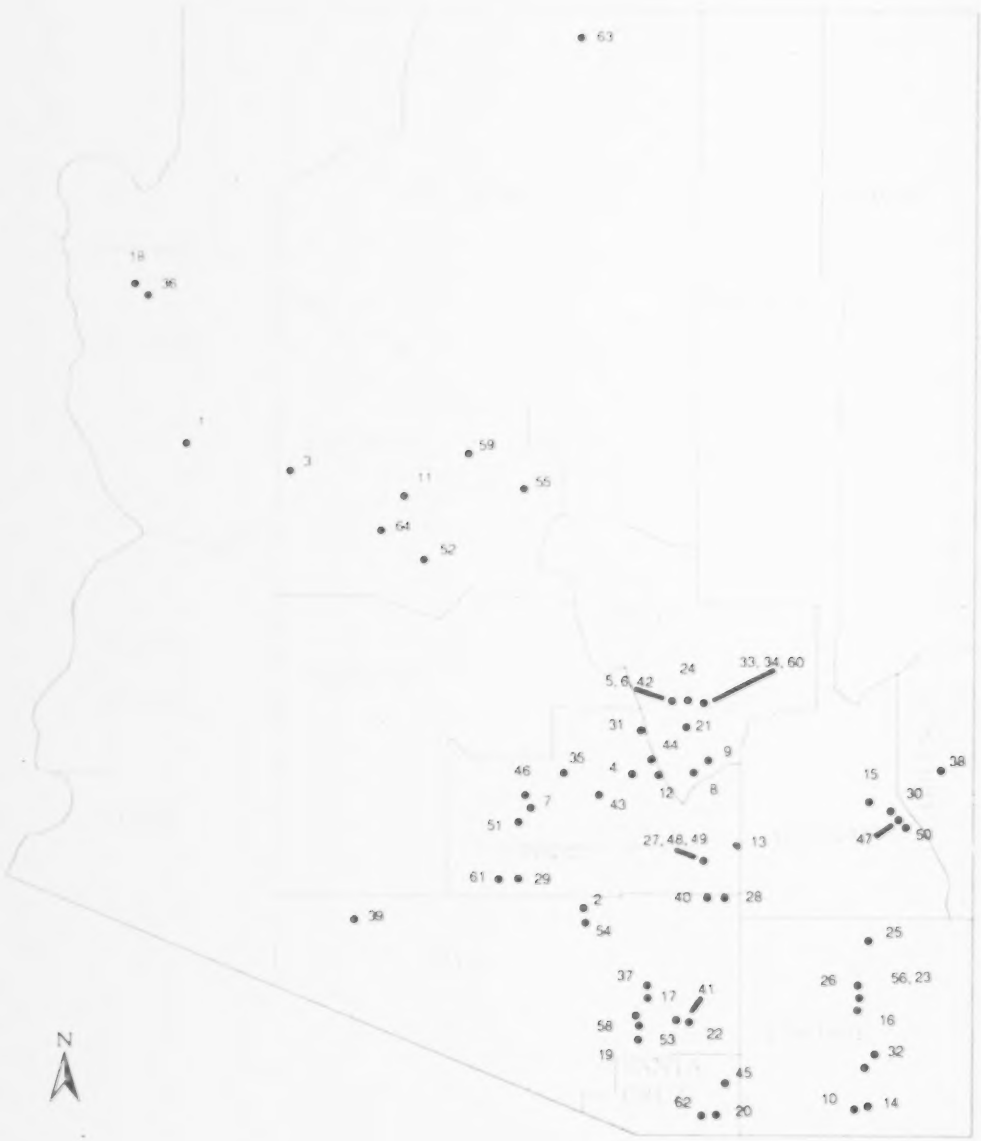
TOTAL COPPER RESERVE BASE IN ARIZONA

Sulfide	6.2 Billion Tons at 0.63% Cu
Acid Soluble	2.1 Billion tons at 0.44% Cu
Mixed	2.5 Billion tons at 0.52% Cu
TOTAL	10.8 Billion tons at 0.57% or 62 million tons of copper

(1 Reserve Base - That part of an identified resource that meets specified minimum physical and chemical criteria relate to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve bas is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently (reserves), marginally economic (marginal reserves), and some of those that are currently subecono (subeconomic resources).
"Mineral Facts and Problems" 1985 Edition, Bureau of Mines Bulletin 675, page 3.

Figure 5. COPPER RESERVES, 1988

1 Antler
2 Atlas
3 Bagdad
4 Buckeye East
5 Cactus
6 Carlota
7 Casa Grande
8 Chilito
9 Christmas
10 Cochise
11 Copper Basin
12 Copper Butte
13 Copper Creek
14 Copper Queen
15 Dos Pobres
16 Dragoon
17 Dynamite
18 Emerald Isle
19 Esperanza
20 Four Metals
21 Gibson
22 Helvetia
23 I-10
24 Inspiration Area Mines
25 Iron Door
26 Johnson
27 Kalamazoo
28 Korn Kob
29 Lakeshore
30 Lone Star
31 Magma Mine
32 Marne
33 Miami East
34 Miami Tailings
35 Mineral Butte
36 Mineral Park
37 Mission Complex
38 Morenci/Metcalf
39 New Cornelia
40 Oracle Ridge
41 Peach Elgin
42 Pinto Valley
43 Poston Butte
44 Ray
45 Red Mountain
46 Sacaton East (LG)
47 San Juan
48 San Manuel
49 San Manuel Open Pit
50 Sanchez
51 Santa Cruz
52 Sheep Mountain Property
53 Sierrita
54 Silver Bell
55 Squaw Peak
56 Strong & Harms
57 Turquoise
58 Twin Buttes
59 United Verde
60 Van Dyke
61 Vekol Hills
62 Ventura
63 White Mesa
64 Zonia



COPPER RESERVES - INDEX BY COMPANY

Company	Deposit
American Pacific Mining Co. Inc.	Atlas
Antioch Res. & Queenstake Res	Zonia
Asarco Inc.	Sacaton East (UG)
Asarco Inc.	Silver Bell
Asarco Inc.	Copper Butte
Asarco Inc.	Ray
Asarco Inc.	Helvetia
Asarco Inc.	Peach Elgin
Asarco Inc.	Buckeye East
Asarco Inc.	Chilito
Asarco Inc.	Mission
Casa Grande Copper Co.	Casa Grande
CF & I Steel Corp.	Dragoon
Cochise Mining Corp.	San Juan
Conoco Inc.	Poston Butte
Continental Union	Oracle Ridge
Cyprus Minerals Co.	I-10
Cyprus Minerals Co.	Lakeshore
Cyprus Minerals Co.	Esperanza
Cyprus Minerals Co.	Mineral Park
Cyprus Minerals Co.	Sierrita
Cyprus Minerals Co.	Bagdad
Cyprus Minerals Co.	Ventura
Cyprus Minerals Co.	Inspiration Area
Cyprus Sierrita	Twin Buttes
Dore Mining & Milling	Four Metals
Durham, A. et al	Strong & Harris
Freeport McMoran	Santa Cruz
Harpoon, Inc.	Sanchez
Hope Mining & Milling Co.	Mame
Inspiration Consolidated Copper	Christmas (OP)
Kerr McGee Corp.	Red Mountain
Keystone Minerals	Korn Kob
Kocide Chemical	Van Dyke
Lodestar Minerals Inc.	Gibson
Magma Copper Co.	Miami Tailings
Magma Copper Co.	San Manuel
Magma Copper Co.	Kalamazoo
Magma Copper Co.	Pinto Valley
Magma Copper Co.	Magma Mine
Magma Copper Co.	Miami East
Magma Copper Co.	San Manuel Open Pit
Magma Copper Co.	Copper Creek
Magma Copper Co.	Cactus
Navajo Tribe	White Mesa
Owens, S.B.	Carlota
Phelps Dodge Corp.	Dos Pobres
Phelps Dodge Corp.	Copper Basin
Phelps Dodge Corp.	Lone Star
Phelps Dodge Corp.	Copper Queen
Phelps Dodge Corp.	New Cornelia
Phelps Dodge Corp.	Morenci/Metcalf
Phelps Dodge Corp.	Cochise
Rayrock Mines	Kay Copper Mine
Santa Fe Mining	Turquoise
Smith, Ken P. et al	Sheep Mountain
Smith, V.A. Estate	Dynamite
Squaw Peak Copper	Squaw Peak
Standard Metals	Antler
Tohono O'odham Tribe	Vekol Hills
TSC Enterprises, Inc.	Emerald Isle
Unknown	Iron Door
Unknown	Mineral Butte

TABLE XXIV

ARIZONA AND U.S. COPPER MINE PRODUCTION IN SHORT TONS OF Cu, 1874-1988

Period	AZ Production (1	Cumulative AZ	U.S. Production (1	Cumulative U.S.	AZ % of U.S. Prod. Ann'l	AZ % of U.S. Prod. Cum
1874-1971*		24,889,171		60,365,183		41.2
1972	847,929	25,737,100	1,664,840	62,030,023	50.9	41.5
1973	867,506	26,604,606	1,717,940	63,747,963	50.5	41.7
1974	804,904	27,409,510	1,597,002	65,344,965	50.4	41.9
1975	751,489	28,160,999	1,413,366	66,758,331	53.2	42.2
1976	956,215	29,117,214	1,605,586	68,363,917	60.0	42.6
1977	852,620	29,969,834	1,503,964	69,867,887	56.7	42.9
1978	908,835	30,878,669	1,496,482	71,364,363	60.7	43.3
1979	957,251	31,835,920	1,591,200	72,955,563	60.2	43.6
1980	760,926	32,596,846	1,301,900	74,257,463	58.4	43.9
1981	1,071,949	33,668,795	1,695,500	75,952,963	63.2	44.3
1982	848,750	34,517,545	1,264,322	77,217,285	67.1	44.7
1983	747,604	35,265,149	1,144,306	78,361,591	65.3	45.0
1984	822,815	36,087,964	1,215,400	79,576,991	67.7	45.3
1985	878,044	36,966,008	1,218,900	80,795,891	72.0	45.8
1986	878,926	37,844,934	1,180,564	81,976,455	74.4	46.2
1987	862,034	38,706,968	1,384,394	83,360,849	62.3	46.4
1988 (Prelim)	942,556	39,649,524	1,584,115	84,944,964	59.5	46.7

* For Cumulative Breakdown 1874-1911 and Annual Production 1912-1971, see "The Copper Industry" by Ken Phillips, published Feb. 1973 by ADMMR.

(1 Source: "Mineral Yearbook - Area Reports: Domestic", U.S. Bureau of Mines and Table I this report.

THE ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

The objective of the Department is to promote the development of Arizona's mineral resources. This is accomplished through technical research, field investigations, compilation of information into a mineral occurrence data base and disseminating information through publications, personal contacts and seminars.

The Department's mining engineers and geologists assist mining and exploration companies, prospectors and others interested in Arizona's minerals with mineral processing, mineral land acquisition, exploration, mine development, financing, government regulations and marketing.

The Department is a service agency and does not regulate, tax, or require any type of registration. The agency provides assistance that is tailored to meet the differing needs of the public. The following is a partial list of services which the Department offers:

- Maintain a site specific data base of unpublished reports and maps which includes 5,000 mine files and indexes of 10,000 computerized Arizona
- Maintain an information bank and library of mineral and mining information including a mine map library (hard copy and microfilm), government publications, periodicals, and unpublished master and doctorate theses.
- Gather and disseminate information on commodities and markets.
- Suggest target areas for possible exploration activity.
- Suggest prospects and individual properties for study and acquisition.
- Assist individuals and companies in their dealings with State regulatory agencies to facilitate their mining and exploration activity.
- Produce publications in the form of mineral reports, annual directories,technical reports, annual mineral industry surveys and information circulars. These include Laws and Regulations Governing Mineral Rights in Arizona, Directory of Active Mines in Arizona, Manual for Determination of Status and Ownership of Arizona Mineral and Water Rights, and others. A current listing of the Department publications is available upon request.